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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue.

War Memorial for Railway Troops

ALTHOUGH various units of the British Army are provided with worthy spiritual homes in the form of their respective garrison churches, the railway troops of the Royal Engineers, until quite recently, have had no more adequate provision for the holding of Divine Service than the dance hall adjoining the Church of England Institute at Longmoor. Only five years ago a disused forage barn was adapted and dedicated as the Longmoor Garrison Church, and since that time it has been the endeavour of the whole garrison, assisted by the Supplementary Reserve Units, to beautify their Church. An important recent step in this direction has been the provision of a beautiful reredos to the memory of the railway troops, R.E., who fell in the war of 1914-1919, and this was dedicated on Sunday last, as recorded in a news article on page 873. Now the time has been reached when the members of the local garrison feel that they are in a position to appeal to all interested in Longmoor to make this Church—dedicated to St. Martin—an even more worthy shrine. An interesting feature of the scheme is the possible provision of four stained glass windows, each representing one of the four main-line railway companies which provide the personnel of the Supplementary Reserve Units. It is to

be hoped that the main-line railway companies will consider this part of the scheme favourably by each arranging to present a suitable window.

* * * *

A Vesting Order Reversed in Ulster

In the Chancery Court, Belfast, on April 22, Mr. Justice Megaw gave an interesting decision of some importance to the Ulster tourist industry when he held that the Northern Ireland Road Transport Board had no power to take over two buses, run for the benefit of tourists in the summer months by an Antrim hotel proprietor as part of his hotel business. The plaintiff, Patrick Murphy, trading as Patrick Murphy & Sons, Antrim and Ballymena, claimed that the board had no right to acquire his buses compulsorily as they were used in connection with the hotel and not the hotels in connection with the buses. He contended, therefore, that the buses were not a "road motor undertaking" within the meaning of the Act. In December last the Northern Ireland Road Transport Board took over the two buses in question under a vesting order of which the plaintiff now sought annulment. Mr. Justice Megaw held that the vesting order should not have been made and gave judgment accordingly. He held that the evidence had established that, to convey guests to or from the hotels and railway stations and quays at Belfast and Larne, the accommodation given by two omnibuses would necessarily and reasonably be required. They were also used for tours advertised as an attraction offered to hotel guests as part of an inclusive tourist programme, but, as the buses were not available for members of the public generally, this user was entirely incidental to the hotel business and not in the nature of a general transport business.

* * * *

The Week's Traffics

Normal comparisons in the weekly receipts of the four group railways are not yet possible as the latest available returns go against those of a week in 1935 which included Easter Monday. Passenger train traffics are accordingly down and merchandise and mineral receipts are up. For the 17 weeks to date the aggregate total shown by the four companies is £47,142,000, an advance of £1,335,000, or 2.91 per cent. This increase is made up of £174,000 from passenger train traffic, £668,000 from merchandise, and £493,000 from coal, coke, and patent fuel.

| | 17th Week | | | Total | Year to date | |
|------------------|------------|------------|-----------|-----------|--------------|--------|
| | Pass., &c. | Goods, &c. | Coal, &c. | | Inc. or Dec. | % |
| L.M.S.R. | 55,000 | + 110,000 | + 101,000 | + 156,000 | + 613,000 | + 3.29 |
| L.N.E.R. | 38,000 | + 46,000 | + 58,000 | + 66,000 | + 444,000 | + 3.23 |
| G.W.R. | 25,000 | + 49,000 | + 47,000 | + 70,000 | + 192,000 | + 2.52 |
| S.R. | 33,000 | + 12,000 | + 10,000 | + 11,000 | + 86,000 | + 1.48 |

The Irish traffic week ends on a Friday and for the fortnight in 1936 which included the period from Maundy Thursday to Easter Tuesday the Belfast & County Down earned £6,292 compared with £6,706 in the corresponding fortnight in 1935. The Great Northern, with a decrease of £1,000 from passengers and an increase of £2,050 from goods, took £41,850 in the 1936 period, and the Great Southern, receiving £153,992 had an increase of £34,872.

* * * *

Railway and Canal Commission Report

Abolition of the Railway and Canal Commission and redistribution of its functions was proposed in a Bill which was introduced in the House of Lords and got as far as a second reading in that House in the Session of 1933, when it had to be dropped because Parliamentary time could not be found for it. It has not been introduced again, and it is difficult to see how the work of the

commission could now be efficiently and economically redistributed in view of the large amount of business before it in connection with appeals under the Railways (Valuation for Rating) Act, 1930, from findings of the Railway Assessment Authority. The latest report of the commission, covering the year 1935, deals with the decisions of the Court on the net annual value of the Southern Railway undertaking as a whole (reducing it from £2,180,000 to £1,077,131), and on the question whether certain "let out" premises at Southern Railway stations, and whether high-tension electric cables and electrical substations, should be considered as part of the railway hereditaments occupied for the purposes of the undertaking of the railway company, or should be separately assessed. Twenty-seven days of the time of the Courts were occupied in hearing these appeals. The judgment of the House of Lords supporting the decision of the Court on the net annual value of the Southern Railway was not delivered until the present year. Pending this judgment the remainder of the appeals relating to the Southern Railway and 80 of the appeals lodged during 1935 relating to the L.N.E.R. remained in abeyance.

* * * *

Competitive Traffic Organisations

As one of our most important functions is to broadcast the experiences of individual railways for the benefit of others, we feel sure that there will be few traffic officers—especially on overseas railways—who will not join us in welcoming the article on page 875 as setting forth clearly the policy of the Leopoldina Railway with regard to constantly increasing road competition. Even those who can find in it nothing revolutionary or even anything that happens to be new to them, will at least be interested to learn how this thorny problem is dealt with, and at any rate partly solved, on the premier British owned and managed Brazilian system. Moreover, we feel sure that many others will be able to improve their defences against the menace by adopting some of the methods of the Competitive Traffic Section described in the article, and by adapting them to their particular needs. The extent to which local government administration assists or—as is more often the case—hinders railway as opposed to other forms of transport, varies greatly in different countries, but there can surely be few railways more handicapped in this respect than the Leopoldina. If factors (f) and (h) in the last column of the article could both be realised, most overseas railway officers would imagine themselves in Utopia, but, in any case, they constitute goals the attainment of which can always be sought.

* * * *

The Safety Paradox

A reaction of Londoners to a recent burst of spring weather, noted in a news bulletin by the B.B.C., was the fact that at one point on a main road leading to the country some 2,000 cars an hour were observed leaving the metropolis. A simple calculation shows that the headway in time between the cars was on the average less than two seconds. Yet a further simple calculation shows that if the cars were travelling at 30 m.p.h. the headway in distance between the cars, ignoring the lengths of the cars, was $26\frac{1}{2}$ yd., while if the speed were only 20 m.p.h. the headway would be as small as $17\frac{1}{2}$ yd. Thus for the pedestrian seeking to cross the road the greater interval in distance between the cars is accompanied by higher speed. Conversely, the lower the speed the shorter must be the headway distance. In the circumstances would not the pedestrian have been happier and safer crossing, for instance, the maze of railway lines at Clapham Junction?

Mauritius Government Railways

Failure of the sugar crop through drought caused a serious set-back to the revenue of the Mauritius Government Railways during the financial year ended June 30, 1935. The length of line worked was $110\frac{1}{2}$ miles of 4 ft. 8½ in. running lines besides 17½ miles of sidings, and also the 13½ miles of the 2 ft. 6 in. Bois Chéri Light Railway. Gradients are very heavy, a great part of the main lines being 1 in 26. Gross receipts showed a fall of Rs. 340,362 in comparison with 1933-34, and it was not possible to reduce the purely operating expenditure by more than Rs. 76,273. For renewals a sum of Rs. 300,000 appears in the 1934-35 accounts, initiating a scheme of depreciation reserve.

| | 1934-35 | 1933-34 |
|---|-------------|-----------|
| Passengers | 3,200,118 | 3,287,714 |
| Paying goods, tons .. . | 279,646 | 385,541 |
| Train-miles | 457,055 | 463,503 |
| Operating ratio, per cent. .. . | 108.46 | 91.64 |
| | Rs. | Rs. |
| Passenger receipts .. . | 510,728 | 524,818 |
| Goods receipts .. . | 928,850 | 1,255,728 |
| Total receipts .. . | 1,596,508 | 1,936,870 |
| Total expenditure (including renewals) .. . | 2,031,516 | 1,797,038 |
| Net receipts .. . | Dr. 435,008 | 139,832 |

In his report on the year under review Mr. H. C. M. Austen, the General Manager, claims that the fall in passenger receipts was due to reduced spending power in consequence of the sugar crop failure and not to road competition. A new halt has been erected between Argy and Quatre Cocos.

* * * *

Railway Air Services in 1936

The plans of the British railways for extending the routes served by Railway Air Services Limited during the forthcoming summer were revealed this week by Sir Harold Hartley. Although operations last year cost the G.W.R., L.M.S.R., and S.R. between them £43,198, the new R.A.S. programme suggests that the four group companies are confident air transport will eventually provide them with an important auxiliary service. The details of the new and improved routes are given on page 874, and from these it will be seen that the general policy is to provide services where surface transport is hindered either by water or mountainous country. It is expected that the total distance flown during the summer will be over 1,000,000 miles, as against the 600,000 miles completed last summer, and the total route mileage covered by the 62 daily services will be approximately 1,400 miles. In several instances steps have been taken to achieve a greater degree of rail and air co-ordination, and the planes on the London-Isle of Wight route will be the first R.A.S. machines to use the new airport at Gatwick on the London-Brighton main railway line.

* * * *

Railway Abandonment in the U.S.A.

The process of railway abandonment in the United States continues with unabated energy, and during the year ended October 31, 1935, no fewer than 122 applications were filed with the Interstate Commerce Commission seeking permission to abandon 2,537 miles of line. The commission granted 100 applications, of which 27 were contested and 73 uncontested cases, involving 336 miles of main line and 784 miles of branch line, of Class I carriers, together with 571 miles of so-called "short lines," of which 463 miles constituted the entire lines of the applicants and 108 miles were portions of such lines. Official information is not available as to the total mileage actually abandoned, but, according to data compiled by Mr. George E. Boyd, Associate Editor

of the *Railway Age*, the total of unprofitable railway abandoned during the calendar year 1935 was 1,843 miles. Although this does not equal the record of 1,995 miles abandoned in 1934, it compares with 1,876 miles in 1933, with 1,452 in 1932, and with 1,626 in 1921, the only other years in which more than 1,000 miles were abandoned. The largest single abandonment during 1935 was that of the Union Pacific between Knox, Kan., and Clay Centre, 144 miles. The St. Louis-San Francisco came next with 104 miles from Belton, Mo., and Clinton, via Tracy Junction to Phenix. The Boyne City, which purchased the old Boyne City, Gaylord & Alpena, abandoned 84 miles of the latter road and thus stands third on the list. The North & South, involving the abandonment of 41 miles, is first in the list of abandonments of entire railways; the Port Bolivar Iron Ore and Tennessee & Carolina Southern are next with 30 miles each; and the Intermountain is fourth with 26 miles.

* * * *

High Speed Pays

The fact that high railway speeds are an economic proposition has received emphatic confirmation from two different sources recently. One was the lecture on "Transport Developments in 1935," by Mr. R. Bell, Assistant General Manager of the L.N.E.R., of which we gave a *résumé* in our issue of April 24, and in which he revealed that the Silver Jubilee streamlined express between London and Newcastle had earned a net average of 12s. per mile in comparison with a general net average for L.N.E.R. passenger trains of 2s. 6d. per mile; furthermore, it is calculated that 25 per cent. more seats in the Silver Jubilee formation would be a valuable asset. The other confirmation comes from Germany, where since 1932 the average speed of the trains has risen on the average by fully 10 per cent. since 1932, and where, as revealed in the tables of fastest German speeds published in our March 6 issue, there is a greater mileage of runs booked at over 70 m.p.h. than in any other country, including the thirteen fastest runs in the world. It is calculated that, so far from adding to operating costs, the increase in average speed referred to has resulted in an annual saving equivalent to nearly two million pounds. Furthermore, the frequency of German train services has risen by 75 per cent. since 1921. Both freight and passenger services are included in the 10 per cent. speed advance, and the general equipment of German freight stock with the continuous brake helps to stress the fact that the train which monopolises an undue share of running lines is not the high speed express, but the loose-coupled unbraked freight train.

* * * *

Systematic Train Services

In the letter which we publish on page 854 of this issue a correspondent stresses the value of the facilities provided between leading cities in the United States, drawing attention to the provision of half-hourly fast services between terminals in New York and Philadelphia which are 89 miles apart, and hourly services (which, as we point out, are supplemented by the competing services of the Baltimore & Ohio) between New York and Washington, 226 miles away. As compared with this, it would be idle to deny that our corresponding inter-city services in Great Britain make a poor showing. Between London and Birmingham, 110½ or 113 miles according to route, though the material exists without any increase of train mileage for an hourly service, yet there is such a gap as from 11.30 a.m. to 2.10 p.m. in the down service, largely because the trains still start in pairs at the old competitive times which were established before pooling came into force; until the evening the London

departures at 9.10 and 9.15 a.m., 11.5 and 11.30 a.m., 2.10 and 2.25 p.m., and 4.5 and 4.35 p.m., show average intervals of two to three hours, instead of one hour, and still less the American half-an-hour. Between London and Manchester, 183 to 188½ miles apart, according to route, although both the principal routes are now owned by the same company, no attempt has been made to alter the similar "pairing" of competitive trains in pre-grouping days, with the result that there are gaps such as from 9.45 a.m. to 12.5 p.m. in the morning service to London. We are entirely in agreement with our correspondent when he claims that there is a field for enterprise in the establishment of frequent systematic services, on the American plan, over main lines in this country.

* * * *

The Measurement of Noise

The phon, a unit for the measurement of noise to which we drew attention in our issue of October 18 last, is given official recognition in a "British Standard Glossary of Acoustical Terms and Definitions" (B.S.S. No. 661—1936), which has just been published by the British Standards Institution. This does not mean that science has rejected the more familiar decibel, but that it has adopted an exacter terminology in which the decibel is confined to measurements of intensity, and the phon to measurements of loudness. Although the phon first received publicity as the basis of another form of limit to be observed by the motorist, it was by no means the intention of those who evolved it that its use should be confined to highway noise traps. A necessary preliminary to the scientific reduction of noise was a standard for comparison and measurement, which is what the phon provides. Railways, which have in the past had to endure criticisms such as that of Carlyle—that an engine whistle is "like the screech of 10,000 cats, and every cat of them as big as a cathedral"—will doubtless find the phon a useful auxiliary in their efforts towards noise reduction.

* * * *

Another American Streamlined Locomotive

For more than 20 years past the Pennsylvania Railroad has had in service a numerous series of 4-6-2 type express locomotives known as the K4s class, which have rendered excellent service in working fast express passenger trains on the company's main lines. Just recently there has been completed at the Altoona works of the P.R.R. an engine of the same general class but streamlined, and this, together with one of the engines in the original form, is illustrated on page 867 of this issue. Although the novelty of streamlining may by now have worn off to some extent, the wind tunnel experiments carried out in this particular case possess certain points of originality. Clay models were used for the experiments, their superiority over wood or other materials lying in the fact that their shapes could be easily and rapidly changed immediately on observing the results of each test. In wind resistance tests the models were suspended in the tunnel over a moving belt, the velocity of the air in the tunnel and the speed of the belt being varied to reproduce the actual conditions when a locomotive is running across country at high and changing speeds. Further details of these tests will be found in the article on page 867. In a communication we have received from Mr. F. W. Hankins, the company's Chief of Motive Power, it is stated that at 60 m.p.h. a reduction of more than one-third in wind resistance is shown, whilst at maximum speed the saving is equivalent to nearly 300 h.p. Twenty-four different models were built to test the streamlining, but only four were carried into the final stages of wind tunnel tests.

Closing of Penarth Dock

SINCE Sir Robert Horne commented at some length in February last to the shareholders of the Great Western Railway Company upon the unsatisfactory return which the company was obtaining from its South Wales dock undertaking, the course of trade has been very closely watched by those concerned, including the various local authorities. The figures for the current year to April 5, which have just been published, reveal that the total imports and exports at Cardiff, Barry, Penarth, Newport, Port Talbot, and Swansea have further declined by nearly 700,000 tons, or about 17 per cent., as compared with the corresponding period of 1935. This extremely heavy drop in tonnage is due principally to the continuance of the acute depression caused in the South Wales coal export trade by the disturbance of normal trading conditions arising out of international politics, trade agreements, and currency difficulties. The combination of these factors resulted in the coal shipments from South Wales in 1935 being about ten million tons or nearly one-third less than in the year 1929. The exact coal and coke figures, given in the G.W.R. official statement we publish on page 876, are 29,985,000 tons in 1929, and 20,018,000 tons in 1935. In particular, certain trade agreements designed to assist the coal trade of the North-East Coast have injured South Wales coal exporters by driving Polish coal to seek markets in the Mediterranean formerly held by them, while the sanctions policy in relation to Italy has been partially responsible for the total cessation of business with that country, which, in 1934, amounted to over two million tons.

Since January 1 there has been a further decline of 800,000 tons in the coal exports from South Wales, with the result that the receipts from the whole of the company's dock undertaking—representing a capital expenditure of over £21,000,000—are insufficient even to cover working expenses, notwithstanding the strenuous efforts which have been made to effect economies in maintenance and operation. In these circumstances, and in the absence of any sign of trade revival, the Great Western Railway has no alternative but to proceed with the reduction of facilities to the minimum required for the traffic to be dealt with, and the company has decided, with great regret, that Penarth dock is to be closed temporarily as from July 6. A proposal to close this dock in 1932 was deferred in response to views expressed by local interests in regard to trade prospects, coupled with a generous offer by Lord Plymouth to forego, for the time being, the royalties payable to the Plymouth estates on coal shipped. The expected revival in trade did not materialise, however, and, in fact, during last year only 978,000 tons of coal and coke were shipped from the dock, as compared with 2½ million tons in 1929, which was by no means a peak year, while there has been a still further shrinkage of business this year.

The company's receipts at this dock have been inadequate to cover working expenses for some years, and, in existing circumstances, the substantial and consistently increasing loss which has fallen on the company has rendered the temporary closing of the dock imperative. The question of the staff which will be displaced on the closing of the dock has received detailed and sympathetic consideration, and the company announces that every effort will be made to effect the closing with the least possible hardship to the men concerned. The tidal coal shipping berths in the Ely harbour will continue to be available for use, and complete access will be given to the premises of the Penarth Pontoon Company to all vessels desiring to proceed to and from that pontoon. It is not anticipated that the closing of the dock will result

in any loss of business, as the existing trade can quite easily be accommodated at Penarth harbour, or the adjacent ports of Cardiff and Barry.

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Interstate Commerce Commission Report

THE latest report of the Interstate Commerce Commission covers the period from November 1, 1934, to October 31, 1935, and was submitted to Congress on December 1, 1935. Future reports will be submitted on January 3 in each year in accordance with an amendment to Section 21 of Part I of the Interstate Commerce Act which became operative on May 23, 1935. Operating revenues of the steam railways of the United States in 1935 continued above the lowest level of the depression, but the pronounced improvement necessary to absorb the increased level of wages and material cost was lacking. Total rail operating revenues of Class I steam railways, including both freight and passenger, in 1932 were 51·2 per cent. of the 1923-25 average; in 1933, 50·6 per cent.; in 1934, 53·5 per cent.; and for the first nine months of 1935, 55 per cent. of the nine months' average in the base period. Total operating expenses in 1932 were 51·7 per cent. of the 1923-25 average; in 1933, 48·4 per cent.; in 1934, 52·6 per cent.; and for the first nine months of 1935, 54·7 per cent. of the comparable base period average. The 10 per cent. wage cut of February 1, 1932, has been completely eliminated, 2½ of the 10 per cent. having been restored on July 1, 1934, 2½ per cent. on January 1, 1935, and 5 per cent. on April 1, 1935. This increase in wage level was met in part by a reduction in employment, which was possible because of a traffic decline in the last half of 1934.

Net railway operating income of the first eight months of 1935 was 12·9 per cent. under that of the same period in 1934, and the operating ratio rose from 74·56 to 77·04 per cent. in the same interval. The accompanying table shows the variations in net railway operating income (before deducting interest) for the first eight months by districts for each of the years since 1930:—

| | | All districts (millions) \$ | Eastern district (millions) \$ | Southern district (millions) \$ | Western district (millions) \$ |
|------|-----------------------------|-----------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|
| 1931 | 8 months ended August 31 .. | 353·9 | 146·1 | 74·9 | 132·9 |
| 1932 | Do. do. | 148·9 | 88·4 | 38·3 | 22·2 |
| 1933 | Do. do. | 280·8 | 137·7 | 80·3 | 62·9 |
| 1934 | Do. do. | 302·9 | 142·3 | 80·0 | 80·6 |
| 1935 | Do. do. | 263·7 | 138·0 | 73·1 | 52·6 |

From this it appears that all districts have recovered considerably from the low net earnings of 1932. These net earnings are, however, overstated to the extent that deferred maintenance has accrued. Class I steam railways taken as a whole met their fixed charges in 1931 with \$134,761,911 to spare, but the net deficits reported since then have been \$139,203,821 for 1932, \$5,862,836 for 1933, and \$16,887,078 for 1934. The deficit of \$16,887,078 for the calendar year 1934 is the net result of \$153,400,639 income of roads reporting an income and \$170,287,717 deficit of roads reporting a deficit.

The report contains a summary of the Motor Carrier Act, passed on August 9, 1935, which imposes new duties on the commission in the regulation of common and contract carriers engaged in the transportation of passengers and property by motor vehicles in interstate and foreign commerce. This regulation includes rates, fares and charges to be applied by the carriers to transportation services performed by them, and safety of operation and equipment. In addition, the commission is required to apply the safety provisions to private carriers, if need therefor is found.

Measured Shovel Packing

WHEN the London & North Western Railway in 1908 replaced the old established method of adjusting rail level by beater packing, in order to provide an even surface to the track, by that of shovel packing, a revolution in permanent way maintenance was started. For many years no other principal railway followed the example of the L.N.W.R., but upon the 1923 amalgamations, when the old railway boundaries were broken and the engineers of one company began to be responsible for the maintenance of lines formerly the property of other companies, the practice of shovel packing came under much wider notice, and its hitherto somewhat neglected merits began to be appreciated. It is now the method used throughout the London Midland & Scottish Railway, and is being used on an extended scale by the other British railway systems. The great improvement in the permanent way of the French railways which was inaugurated after the war was accompanied by the institution of shovel packing on the Northern Railway of France, and was improved on to the extent that the amount of fine ballast required to raise low places in the rail surface to the correct level was accurately measured, nothing being left to trial and error and the idiosyncrasies of individual permanent way men. This system of measured shovel packing was described in THE RAILWAY GAZETTE of July 3, 1931. It has been practised with great success on a wide scale since, and further slight refinements have subsequently been introduced, particularly in regard to the method of measuring the amount of packing required and the implements with which fine ballast is placed in position. Many engineers, however, have been averse to adopting the elaborations found successful in France, and although the merits of measuring the amount of packing required is recognised, simplifications in the method of measuring it have been tried. On page 864 will be found one such method, which has been instituted with successful results on the Buenos Ayres & Pacific Railway.

* * * *

A European Trunk Line

AT the General Meeting of the Central European Railway Association, held at Lugano last year, the Chairman of the Danube-Save-Adriatic Company, Präsident Dr. Fall of Vienna, gave an instructive address on the work of the old Austrian Southern Railway Company, and the many vicissitudes through which the lines owned by it had passed in consequence of the numerous and extensive political and economic changes which have occurred since they were originally built. The Südbahn system sprang from a line, owned by a company established in 1838, between Vienna and Gloggnitz, a distance of 75 km. (46.6 miles), and subsequently developed, chiefly with the aid of French capital, into the large concern rejoicing in the imposing title of "The United South Austrian, Lombardian, and Central Italian Railway." The wars of 1859 and 1866 resulted in the cession of Lombardy and Venice to Italy, and the company sold its lines in those territories, by force of circumstance, to Italian purchasers, leaving the main route between Vienna and Trieste via Graz and Klagenfurt still in Austrian hands. In consequence, the company changed its name to "Imperial and Royal Privileged Southern Railway" and was popularly known for many years simply as the Südbahn. It owned a system amounting to 2,235 km. (1,389 miles) of railway, forming one of the most important routes on the Continent, in that it afforded an outlet to the Adriatic Sea for a large area, and was one of the principal means

of communication between Austria and Hungary, the partners in the old Dual Monarchy. The two countries, in spite of their dynastic association, pursued different economic policies in many respects, and it was no easy task for the old Südbahn management to reconcile them with its own interests. Hungary, for instance, wished to grind its corn and export flour to Austria, while the latter sought to import the corn and do the milling itself. In addition, pressure on the company was often exercised by royal and other authorities to induce it to pursue some desired line of action, and all the diplomacy of which the board was capable was required to satisfy the conflicting claims on the company's services. That the officials concerned succeeded in great measure in these tasks appears to have been generally recognised in the course of time, and even now the experience of those days is turned to with advantage.

The great war effected a complete revolution in the fortunes of the Südbahn, which ran through territory which was the scene of severe fighting. The equipment of the line was almost completely worn out, where not altogether destroyed, and the finances of the company were reduced to a state bordering on collapse. The economic conditions in the districts traversed were upset. At the end of hostilities the line was required to carry large numbers of returning troops, and the supplies required by the famished districts of the interior; any further delay in this respect would have had disastrous consequences. Some hasty reconditioning of the line enabled this to be done, and the War Council in Paris, recognising the importance of keeping the railway going, appointed a commission under American chairmanship to co-operate with the management. Fortunately, the great majority of the staff remained loyal to the board and worked energetically to enable the communication between the sea and central Europe to be effectively re-established. The Treaties of St. Germain and the Trianon, as a result of which the Südbahn route now passed through four states, none too friendly with each other to begin with, nevertheless recognised the necessity of ensuring that the Adriatic route be preserved. They provided, therefore, for an agreement to that end between the States concerned and the company. This was concluded at Rome in 1923 after prolonged and difficult negotiations, its text being very complicated and not easy to interpret. Mutually conflicting interests had tried to influence the result. Some wished to see the continuity of the line broken up in the interests of an extreme nationalism, but larger views saw the folly of interfering with a great trade channel of long standing, and fortunately they prevailed. All kinds of schemes were elaborated for the working of the line, and a compromise was at length arrived at, leaving the company in existence and in possession of its lines, the States claiming no right to purchase until the end of the concession period. The working was, however, not left in the company's hands for long, Italy, Jugoslavia, and Austria soon taking it over in their respective territories, although Hungary did not do so until 1932. Another name was adopted, after much discussion, in an endeavour to please all parties, that of Danube-Save-Adriatic Railway, although the old short name of Südbahn survives in some quarters as a more convenient title.

Compensation is paid to the company by the various governments on a gold franc basis, calculated in proportion to the gross traffic conveyed on the respective sections of line, so that the management is vitally interested in all questions affecting rates and fares, and anything bearing on the business capacity of the undertaking. The board has representatives of the bondholders among its members, and there is a committee of management on which the four countries above mentioned have representa-

tives. The company has thus a certain authority in tariff questions, and is a member of the international organisations dealing with them, as well as the International Railway Congress Association and the Central European Railway Association. It has taken the initiative more than once in proposals which have led to improved operation of the international fast goods services and, at the express invitation of certain countries, has taken a leading part in the establishment of simpler customs arrangements and formalities; these have in turn assisted

to expedite the international services. The drafting of improved forms of waybill and other documents is also due to Südbahn initiative. Owing to its close interest in sea transport on the Adriatic, the company has associated itself with the Austrian and Hungarian Ports Associations, with the object of preventing wasteful competition between certain coastal districts. These facts show, as Präsident Dr. Fall pointed out at the conclusion of his interesting address, that the spirit of the old Südbahn has persisted in its succession.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Fuel and Liberty

Liberty Restoration League,
24, Essex Street, W.C.2, April 6

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—I write to thank you for the kind notice that you have given, in your issue of April 3, to the leaflet recently published by this association entitled "A National Fuel Policy"; but I beg to draw attention to an observation made in your columns in this connection. After observing that we "put forward a case for a much larger use of coal," and after referring to the "alarming prospect in these days of wars and rumours of war," arising from our dependence upon foreign fuel, you say that, "nevertheless all the nostrums, whether of so-called Liberty Restoration Leagues or of Political and Economic Planning Groups, neglect the obvious solution which is, of course, to increase internal purchasing power."

The fuel policy advanced by the Liberty Restoration League, which would be of inestimable advantage to our distressed areas, and which would remove our national dependence upon foreign fuel, is, in brief, the cessation of subsidies, direct or indirect, and of other legislative favours to foreign oil. This "nostrum" concerns a principle that is quite separate from that of purchasing power. The greatest possible increase in internal purchasing power would be of little advantage to the coal industry or to the railway transport industry if the present policy of favouring the oil industry were to persist. This policy is responsible for the purchasing of oil where, otherwise, coal would be purchased.

Yours faithfully,

ARTHUR ROGERS

[The basis of our suggestion was that, to increase internal purchasing power up to the amount that would make possible the consumption of as much of the product of our industry as the people of the country want, would eliminate the necessity for exporting the surplus which they cannot now buy. It is this forced export of surpluses (in excess of imports) which is the main cause of war, and so the adoption of our suggestion would avert the supreme danger feared by the Liberty Restoration League.—ED. R.G.]

Systematic Train Services

99, Clifton Road, S.E.25, April 17

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—There may seem little to be added on the subject of American train services after Mr. C. J. Allen's very searching analysis in your issue of February 21 last. Yet, if you can afford the space, it may perhaps be worth while to print in full the timetables now operating in the most populous area of the United States, where conditions are quite comparable with those obtaining here. The comment of an American engineer, to the effect that the British railway problem is merely a suburban problem on a gigantic scale, is doubtless familiar enough. How true it is, and how the principal towns of England would be provided for if they occurred in a land where the suburban nature of the problem would be apparent, only the appended timetables can show.

Philadelphia, with a population of just over 2,060,000, at a distance of 86 miles from New York, enjoys a half-hourly service of expresses throughout business hours. Baltimore, with 819,000 at a distance of 186 miles, and Washington with some 560,000 at 226 miles, are provided with an express service at least once every hour. Is it too much to claim that an equally rich field for enterprise exists over here?

Yours faithfully,

K. H. JOHNSTON

[Our correspondent has, if anything, understated his case. Considerations of space do not allow us to publish the full timetables to which he refers, but it may be stated briefly that, in addition to the half-hourly service of electric expresses of the Pennsylvania between New York and Thirtieth Street station, Philadelphia, there are the long-distance expresses from New York which call at North Philadelphia, making a total of 52 fast trains in each direction daily between the two cities. The hourly Pennsylvania service between New York, Philadelphia, Baltimore, and Washington is supplemented by the competing express service of the Baltimore & Ohio. Over longer distances the world can show no parallel to the service between New York and Chicago, which, over routes varying in distance from 908 to 961 miles, has now 22 daily trains making the journey in less than 20 hr., and averaging between them 50.4 m.p.h., all stops included, for the entire distance.—ED. R.G.]

Weber and the Centenary of Ampère

London, April 20

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—Your recent editorial note referring to Ampère reminds me that the unit of current was for a time apparently called the *Weber*, in early days of electrotechnics, after Wilhelm Eduard Weber, the German physicist (1804-1891). Weber, who was born at Wittenberg on October 24, 1804, studied at Halle and became professor of physics there in 1828. He occupied a similar post at Göttingen from 1831 to 1837. Expelled for some political activities, he accepted the chair at Leipzig in 1843, returning later to Göttingen, where he died on June 23, 1891. He it was who largely put the science of electrical measurement on a sound basis, doing for electric currents what K. F. Gauss had done for magnetic forces. He is said to have constructed a magnetic device giving a wireless effect over a space of 9,000 ft. He was greatly interested in wave action in physics and published a treatise on it based on numerous experiments.

In early popular books on electrical matters one sometimes sees the following lines, intended to make the various electrical units easily remembered:—

Through many an *Ohm* the *Weber* flew
And clicked this answer back to me:
I am thy *Farad* staunch and true,
Charged to a *Volt* with love for thee!

Whether one volt would now be regarded as enough pressure for love is, of course, open to discussion! It is possible, however, that the unit in the above verse is meant to be what is now called a coulomb. Can any of your readers state precisely what the *Weber* really was?

SIGNALMAN

PUBLICATIONS RECEIVED

Axleboxes and Related Parts: Their Maintenance on Locomotives, Carriages, and Wagons. By R. E. Brinkworth. London: The Locomotive Publishing Co. Ltd., 3, Amen Corner, E.C.4. 11½ in. × 8½ in. 80 pp. Price 6s. 0d.—This publication deals with a subject of the greatest interest and importance to everyone concerned with the building and running of locomotives and trains. It covers all the main aspects of axlebox design and maintenance in sufficient detail to be of practical value as well as general interest. Points such as the precautions against hot boxes and the treatment of these defects when they occur in the course of a run are given a special section, and as is only natural, adequate space is devoted to the important question of lubrication. The various types of axleboxes and their related parts are illustrated and described, these including roller bearing boxes and special types such as the Isothermos; the matter throughout covers axleboxes both for locomotives and various types of rolling stock. Other chapters are devoted to wheels and springs, and there is an appendix which deals with a special method of fitting and machining horn-cheeks, axleboxes and cylinders. The author's past connection with an Indian railway is reflected in the pages of the work, but not sufficiently to rob its contents in any degree of general interest. The book is certainly very informative and well arranged.

Railway Maintenance Problems.—By Lt.-Col. H. A. Hull, M.Inst.C.E., late District Engineer, L.M.S.R. London: THE RAILWAY GAZETTE, 33, Tothill Street, S.W.1. 8½ in. × 5½ in. 82 pp., 51 diagrams. Cloth covers. Price 5s. net.—The appearance of a book of this kind is unfortunately a rare—almost unique—occurrence, and railway engineers, particularly those who find themselves responsible for maintenance work for the first time, should be grateful to the author for laying before them so frankly the results of his long and wide experience. The average technical book makes dry reading, and either because a vivid recollection of many hours spent poring over them has produced a lifelong distaste for such works, or possibly because of some form of modesty, the fact remains that the practical man but seldom records his experience for the benefit of succeeding generations.

Within the small compass of 75 pages divided into ten chapters, the author has compressed a wealth of valuable information upon earthworks, including the treatment of slips, drainage of permanent way, foundations, and bridge and building maintenance, together with much sound advice upon the upkeep of permanent way. A chapter is devoted to mishaps attributable to the permanent way and in the final pages the author discusses the method and merits of shovel packing, which origi-

nated on the old L.N.W.R. No doubt some of the ways of treating maintenance problems described by the author will meet with criticism, nevertheless they have the merit of having been actually employed and found satisfactory, so that even if there is controversy as to whether any particular method of treatment is in fact the best, the reader will at least have the satisfaction of knowing that by adopting the author's suggestions he will certainly not make matters worse.

This book can be recommended to all young railway engineers, who should find it most useful when they come to graduate in the hard school of railway maintenance. As there is a complete absence of mathematics and formulae, it should also appeal to the more up-to-date and ambitious inspectors in charge of permanent way, bridges, or buildings. Lastly, we would venture to commend it to those august and fortunate folk whose whole professional life has been spent in the design and execution of new works and who have never for their sins had to maintain them. It is a well-produced book, printed in bold, clear type, and the diagrams and drawings are exceptionally good and easy to follow, while pertinent dimensions are shown clearly. There is, moreover, a first-class index, which makes the book easily usable for quick reference.

Der Einfluss des Frostkerns auf die Imprägnierung der Buchenschwellen. (The Influence of Frost-Heart on the Impregnation of Beech Sleepers.) By A. Nowak. Vienna, 1936: Julius Springer 9½ in. by 6½ in. 23 pp. 15 ff. Paper, 1.45 Marks.—Formerly, Austria relied mainly on imported oak for sleepers, but the economic difficulties of recent years have led to appreciation of the fact that impregnated native beech is cheaper and more durable. During the exceptionally severe winter of 1928/29, a temperature of -42° C. (-44° F.) persisted for weeks in East Galicia and East Prussia, resulting in serious damage to beech trees, particularly by the formation of a grey-brown intermediate zone called "frost-heart." This was probably due to the frost-damage to the sap wood forcing sap deeper into the wood, and its effect was to cause the more or less extensive formation of red-heart (a formation protecting against the penetration of fungus), and hence to render difficult the impregnation of the wood.

The author explains the difficulty of recognising frost-heart in timber which has grown during the intervening years. In some circumstances the high moisture content of the frost-heart opposes its impregnation, but the main difficulty seems to be to distinguish it from red-heart, and the Austrian Federal Railways have adopted a clause limiting both these conditions to one-fifth of the cross-section, not extending into the upper one-third of the sleeper. The character of the frost-heart varies con-

siderably according to the climatic conditions to which the timber has been exposed. In Austria, beech sleepers are impregnated by a double process, and a sleeper of 0.09 cu. m. (3.2 cu. ft.) takes up 20 kg. (44 lb.) of zinc chloride and 12 kg. (26.5 lb.) of tar oil. The author presents the results of tests by earlier investigators and details of his own series of trials, and concludes that double impregnation is reliable for all but extreme cases, the easily diffusible salt solution or gas oil penetrating the frost heart, and the tar oil forming a protection in the outer zones.

Cruises of the Northern Belle.—In connection with the three rail cruises from King's Cross by the Northern Belle of which we gave the itinerary in our issue of February 14, the L.N.E.R. has published an attractive illustrated folder of information for prospective travellers. This includes a map of the route and a plan of the train, depicted on the front cover headed by the well-known Pacific locomotive *Flying Scotsman*. The selection of views in the folder, which is produced in a pleasing combination of green and brown, gives an excellent impression both of the luxurious interior of the train and of the fine scenery through which it passes.

Student Travel.—The facilities for cheap and extensive travel offered to the modern undergraduate by the National Union of Students are a valuable auxiliary to his education, and a means of increasing his value to society in general and transport interests in particular. We have received from the union, which has its headquarters at 3, Endsleigh Street, London, W.C.1, a booklet of holiday travel and touring arrangements for 1936, among which may be mentioned an ambitious programme for a summer tour to South Africa at an inclusive cost of £74. European interests are, of course, also catered for, and a feature of the arrangements is the low price but comprehensive nature of the facilities.

Electric Grinders.—An illustrated leaflet received from S. Wolf & Co. Ltd., Pioneer Works, Hanger Lane, Ealing, W.5, describes two moderately priced electric grinders—one of the flexible shaft type and the other for bench or pedestal mounting. Both have very complete specifications, and represent the latest practice in equipment of this type. The flexible shaft grinder is supplied in floor or pedestal patterns, and the driving motor itself is mounted on ball bearings so that it follows the movements of the shaft and keeps the drive always in alignment. A Bowden control switch is provided at the tool-holder end of the shaft, falling immediately to hand for the operator. Wire scratch brushes and calico polishing mops can be supplied for use in place of the grinding wheel. The bench grinder (also obtainable on a 33½-in. pedestal) has coarse and fine wheels permanently in position. A twist drill grinding attachment can be readily fitted, and provision is made for taking polishing mops up to 7 in. dia.

THE SCRAP HEAP

MUSIC AT PADDINGTON

The G.W.R. Staff Military Prize Band composed of signalmen, porters, guards, engine drivers, &c., has begun its season of Saturday evening concerts at Paddington by playing on the "Lawn" from 8.30 p.m. onwards.

* * *

When railways were introduced and astronomical gave place to Greenwich time, the Vicar of St. Mary's, Shrewsbury, refused "to budge before the tyranny of a new railway world," and the clock of St. Mary's continued during his life to be faithful to astronomical time.—From the "Western Mail."

* * *

FRIENDSHIP

A Birmingham L.M.S.R. carter had the misfortune to be fatally injured in a lift accident at a factory where he was collecting goods, and another man was sent to bring back the load. The horse, however, refused to move, and it was necessary to requisition a chain horse to bring the other horse back to the stables.

* * *

LOST in Bond Street April 20th, OLD DUTCH SILVER TOBACCO BOX, 5 in. by 3 in., engraved on outside with a train, inside an inscription in Dutch and 1872. Generous award given if returned to Hancocks & Co., 9, Vigo Street, W.1.—From "The Times" small advertisement columns of Friday last, April 24.

* * *

COFFIN LEFT BEHIND

A coffin has been offered for sale by the Ceylon Railways lost property authorities. It was left behind by a sad traveller or hopeful undertaker, whose bad memory was, however, stronger than either hope or sorrow. It first received no bid despite the efforts of the auctioneer to convince his audience of its usefulness. Eventually some deer horns were added to the lot and bought for a shilling. The purchaser can use the horns for decoration purposes, but does not know what to do with the coffin.

* * *

On the French railways it was customary for the smaller level crossings and halts to be kept by the wives of the platelayers. These women were called by the travelling public "Des alteses," from a play upon the words, for the class of station kept by women are "haltes." There is an amusing story of the presence of mind of one of these crossing keepers on one occasion when she saw a light engine proceeding on the wrong line. She at once saw the danger, but failed to catch the attention of the engine driver. In desperation, as the locomotive came opposite to her, she whipped off her sabot and flung it at the driver, which effectually stopped him, and at the

same time prevented a possible accident.

* * *

ON A RUSSIAN PEASANT TRAIN

"I on the other hand, was on my peasant train partly in order to get to Mongolia cheaply, and partly in order to be on a Russian peasant train!" In these terms Mr. G. D. R. Phillips opens an article in a recent issue of the *British-Russian Gazette* and *Trade Outlook* describing a journey on the Trans-Siberian Railway. A lucky cancellation enabled him to get his ticket without the customary precaution of booking a fortnight in advance, and the reader is at first disposed to envy the Russian peasant for his freedom to travel in such great numbers and over such long distances. "Peasant" train, however, seems to be a term of some latitude, for we notice that the travelling companions specifically mentioned by Mr. Phillips are a railway surveyor, four wireless engineers, and an ex-Commander of the Red Army.

The author, however, determined to sample the true proletarian atmosphere, travelled in the "hard" class, where each passenger is entitled to one of the wooden berths, arranged in two tiers on each side of a centre-corridor coach, as his day and night accommodation. "Soft" class carriages have compartments with four sprung and upholstered berths in each. Mr. Phillips tried one of them, but complains that the liveliness of the springing gave him a headache. We are left to imagine where an ache was induced by the "flat, bare, bench" to which his own ticket condemned him.

In addition to these amenities, there was a restaurant car for passengers of both classes, but catering seems to have been left to the initiative and resource of the travellers themselves.

Food could be bought from peasants' stalls at stations, and the strong or fortunate were able to gain a place at the hot water tap provided on every platform, thereby securing the wherewithal to boil the eggs and make the tea which seem to have been the staple items of diet.

As the train ran on into Siberia, the passengers either purchased wild flowers at stations to decorate the carriage windows, or took the opportunity of plucking them at the line-side while the train was waiting in a passing loop on a single-track section. On one occasion the driver himself joined in these picturesque activities, and when the line was clear was seen to open the regulator with one hand while clutching a bunch of flowers in the other.

On this journey there seems to have been little of the proverbial Russian gloom. Stations are described as cheerful and clean, often having gardens and in certain cases a rockery and fountain. At important stops the carriages were thoroughly washed internally. In fact, but for the sight of goods trains loaded with agricultural machinery, and, near the Mongolian hills, the "clouds of aeroplanes buzzing about," it might have been supposed that Pan had deposed M. Stalin and established a teetotal Arcadia whose inhabitants preferred the samovar to the commissar.

But for an overheated connecting rod bearing, and a halt while the track was repaired in a tunnel ahead, Mr. Phillips completed his 4,000-mile journey without untoward incident and at an average speed of 25 m.p.h. He ascribes a certain roughness of running to the small depth of unfrozen soil below the track, in some cases no more than six inches even in summer. Signalling, he noticed, is of the three-position upper quadrant type, and is being largely electrified and converted for automatic block working.

The first stone of the Baltimore and Ohio Railroad, which was laid on the outskirts of Baltimore on July 4, 1828, was set up last year in the first floor of the company's General Office Building at Baltimore. In the illustration on the right it is seen in this position below the glass-encased implements used at the original laying by Charles Carroll of Carrollton, the last surviving signatory to the U.S.A. Declaration of Independence



OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

INDIA

Railway Works Programme, 1936-37; A.-B.R.

The Depreciation Fund and Capital programme of the Assam-Bengal Railway amounts to Rs. 53.47 and a net provision of Rs. 51 lakhs is made in the budget. A sum of Rs. 22 lakhs is provided for the construction of the Meghna Bridge. Track renewals will absorb the major portion of the allotment for open line works. Under rolling stock, provision is made for 5 YB class locomotives and for the addition of 15 tank wagon bogies for kerosene oil traffic. There are no open line works of importance.

South Indian Railway

The South Indian Railway Budget for 1936-37 provides a net sum of Rs. 81.50 lakhs under the Capital and Depreciation Fund programme. The estimate of Rs. 22.38 lakhs under rolling stock includes provision for: broad gauge: 20 luggage vans (8 of them all-steel) and 14 all-steel motor vans, also: metre gauge: 52 bogie coaches and 12 all-steel vans, as well as the conversion of 6 m.g. first class bogies into composite vehicles. Certain expenditure is also to be incurred on the rolling stock of the Travancore Railway. The expenditure under track renewals is estimated at Rs. 32.62 lakhs. Important works in progress include the remodelling of Shoranur, Madras and Pollachi junctions, Madura power signalling, stage 1 of the Coimbatore remodelling, and the construction of the Coimbatore-Singanallur link. A sum of about Rs. 4½ lakhs is provided for the renewal of girders of the Cheyar, Palar and other bridges, in order to enable YD class engines to run over these bridges without speed restrictions.

M. & S.M.R.

The estimated Capital and Depreciation Fund expenditure for 1936-37 on the Madras and Southern Mahratta Railway amounts to Rs. 96.66 lakhs, all of which is for rolling stock and open line works. With allowance for probable savings, a net provision of Rs. 84.70 lakhs is made in the budget. The rolling stock programme is estimated to cost Rs. 28.82 lakhs and is entirely one of betterments. For the broad gauge section provision is made for two special type shunting engines, 15 boilers, 24 coaching vehicles of various types including 10 all-steel combined motorcar and luggage vans; also 40 OM type wagons, 6 travelling cranes, 4 oil tank wagons and one 65-ton steam breakdown crane with support wagon. The provision under metre gauge includes the transfer from the Mysore State Railway of 5 YC class engines, the renewal of 9 boilers, 20 coaching

vehicles, and 14 tank wagons. An allotment of Rs. 6 lakhs is made in respect of stock for which provision has been made in a previous budget. A sum of about Rs. 6 lakhs is budgeted for rolling stock intended for the Mysore State Railway and this sum includes the cost of 5 YB class engines for the Mysore Railway in replacement of the 5 YC engines transferred to the M. & S.M. Railway. The estimate for track renewals exceeds Rs. 49 lakhs.

UNITED STATES

"Job Freezing" Bill in Congress

A Bill known as the Crosser-Wheeler Bill, written by the railway unions, is pending in Congress which would make it virtually impossible for the railways to make any changes in their service which would alter the employment status of any employee, without first securing the consent of the Interstate Commerce Commission. The railway managements are negotiating with union representatives in the endeavour to reach agreement with them for the protection of employment in rationalisation projects, and the Crosser-Wheeler Bill parallels the subject of these negotiations. The unions in recent years have increasingly relied upon legislation rather than negotiation to secure their objectives—thus abandoning the principle of "collective bargaining" for the acceptance of which they so long contended. The railways are politically almost impotent in any controversy with the unions which reaches the national legislature.

Exceptional Rates Bill Passes Lower House

When the railways and the unions join together in a legislative project, however, they appear to have considerable influence. This is shown by the passage of a Bill to permit railways to establish exceptional rates to more distant points, where highway or water competition exists, lower than those to intermediate points where competition does not exist. Such rates are now forbidden under Section 4 of the Interstate Commerce Act, known as the long-and-short haul clause. The repeal of this restriction was opposed by the motor and water carriers, by the Interstate Commerce Commission, and by the Federal Coordinator of Transportation, Mr. Joseph B. Eastman. Nevertheless the railway cause triumphed in the Lower House, a fact which shows that the railways and their employees acting in unison are not without power. If the Bill should become law it would assist greatly in restoring to the rails much traffic now moving by competing

transport agencies—particularly by intercoastal vessels operated through the Panama Canal.

TASMANIA

Dates of Various Developments

The four-mile extension of the Derwent Valley line beyond Fitzgerald is now completed. The five new Sentinel-Cammell steam railcars on order in England are expected to be shipped, received and running by the end of the year.

NEW SOUTH WALES

Railcar Trains

The policy of using motor trains each consisting of a railcar hauling two or three trailers has proved so successful on the N.S.W. Government Railways that a further four are now on order for country branch lines. The number of trailers depends upon the gradients on the particular branch, a railcar and two, seating 24 first and 53 second class passengers, are used on heavily-graded branches, and a third trailer accommodating an additional 59 third class passengers can be added in easy country. Special attention is being paid in the new cars to the reduction of noise and to the improved springing of the reversible seats.

SWITZERLAND

Lötschberg Tunnel Jubilee

On March 31 last, the Bernese Alps Railway celebrated the 25th anniversary of the completion of the boring of the Lötschberg tunnel. Work was begun at Kandersteg on October 15, 1906, and at Goppenstein (at the southern end) on the following day. Progress was made at an average rate of 10 m. daily, and the maximum attained was 12.8 m. This rapid advance was due to the use, for the first time, of compressed air borers of a new type. Unfortunately, the undertaking did not prove such a straightforward matter as had been expected. On July 24, 1908, at 2.30 a.m., the end of the solid rock was reached on the north side, and within ten minutes the tunnel was filled with water, stones and gravel for about a mile of its length. Twenty-five Italian workmen lost their lives, and work was suspended for several months. A portion of the tunnel was finally stopped up by a wall 10 m. thick and abandoned, and a fresh heading was made, avoiding the dangerous zone. The completed tunnel has consequently three curves and is 800 m. longer than as originally planned.

In spite of this alteration to the alignment of the tunnel, the calculations made by Prof. Bäschlin proved so exact that there was a difference in alignment of 25 cm. only when, on March 31, 1911, the two headings of the tunnel met, as depicted on page 870. This happy event took place at 4 a.m.; M.

Moreau, who was in charge of the southern heading, passed a bouquet to Herr Rothpletz, the engineer for the north side, and later clambered through the opening, after which champagne was served to all the workmen in the tunnel. In April, 1912, the masonry was completed, and on July 15, 1913, the whole of the new line from Frutigen to Brigue was opened to traffic, with electric traction on the 15,000-V. single phase system. The total length of the tunnel, which is for double line throughout, is 14,612 m. (9.1 miles) in length. From an altitude of 1,179 m. at Kandersteg, the line rises to 1,243 m. in the tunnel and descends to 1,220 m. at the southern entrance, Goppenstein: 4,419,305 bore holes and 960,918 kg. of dynamite were used in its excavation.

Development of Double-Track Mileage

A recent article by Mr. H. Nydegger in the *Swiss Federal Railways Bulletin* gives interesting figures regarding the doubling of lines since the formation of the Federal Railways system in 1901-1903. Of a total length of 1,105 km. (686 miles) of double track at the end of 1935, only 532 km. (330 miles), or 48 per cent., were double when taken over from the private companies, and 573 km. (356 miles), or 52 per cent., were subsequently doubled by the Federal Railways, at a cost of 216 million Swiss francs. These figures do not include the double-track connecting line between the Basle and Zurich routes east of Olten station, nor the double-track deviations between Basle Swiss station and Basle—St. Jean, and between Zurich Main station and Wollishofen. The aggregate route length of the Federal system at the end of 1935 (excluding the narrow-gauge Brünig line) was 2,845 km. (1,766 miles), of which 1,739 km. (1,080 miles), or 61 per cent., are single-track.

It is intended to proceed with doubling where it is most urgently required, as soon as financial conditions permit. At present, the only single-track gap in the transversal line from Geneva via Berne and Zurich to Romanshorn is between Romont and Fribourg, but the Gotthard route is single from Emmenbrücke to Lucerne, Lucerne to Immensee, Brunnen to Flüelen, Riviera-Bironico to Lugano, and Melide to Maroggia, a total distance of 57 km. (35 miles).

FRENCH AFRICA

Trans-African Railway

Increased attention is being paid in France to the question of the trans-Saharan railway, and under the direction of M. B. Delabeye, Councillor of Foreign Commerce, proposals have been drawn up to make the trans-Saharan line into a trans-African route by prolonging it along the northern frontier of Nigeria and then southward past Lake Chad to Ubangi, as shown on the accompanying map, and ultimately to join up with the lines in the Cameroons

and with the Congo-Ocean Railway, opened in 1934. It is understood that these proposals have been laid before the committee set up some time ago by the French Government to study the trans-Saharan projects. The total distance from Colomb Bechar, in Algeria, to Ubangi by the proposed route is 3,500 miles, and to the Congo, 4,400 miles. The whole line would take at least 12 years to build, and the estimated cost is over 4 milliards of francs.

ARGENTINA

The Transandine Railway Problem

On March 20, an Argentine Government commission, headed by the Director of Customs, Señor Augustin Pinedo, left Buenos Aires for Chile, where it is co-operating with a Chilean commission in studying the best way of re-establishing the Transandine Railway service. The agenda for discussion includes the following subjects:—

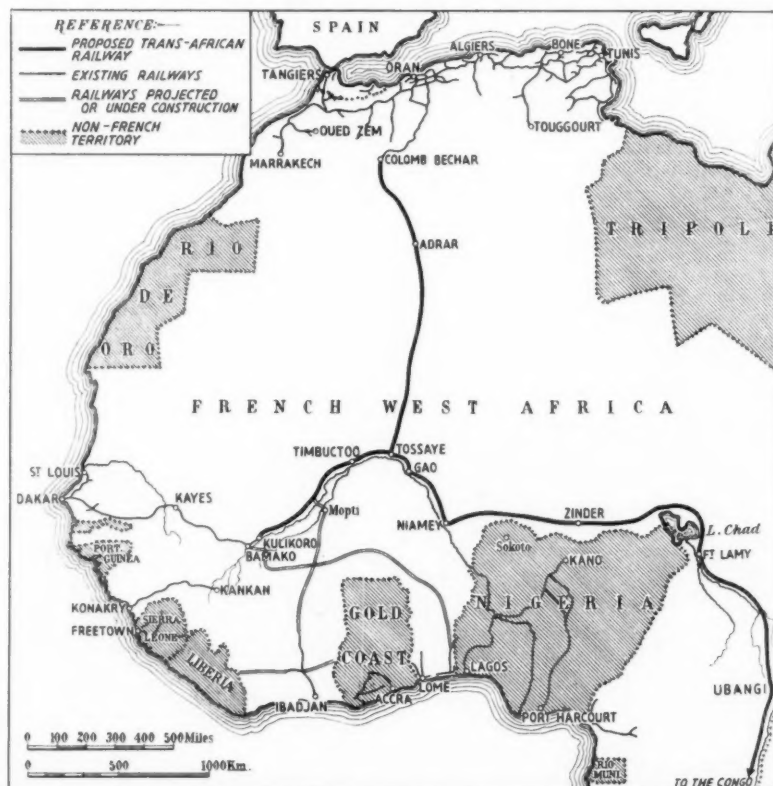
- (a) The technical committee's proposals for the reconstruction of the line.
- (b) Unification of the track and rolling stock on both sections of the railway.
- (c) Tariffs.
- (d) Co-ordination of rail and road transport between Argentina and Chile.
- (e) Such modifications as may be considered necessary in the Argentine-Chilean commercial treaty of June, 1933, with a view to increasing the passenger and

goods traffic between the two countries, so as to ensure a regular railway service.

Of the points to be discussed, the last is likely to present the greatest difficulty. Technically, the rebuilding of the damaged portion of the line involves no greater difficulty than the original construction, but the financial and commercial problems are much more complicated. In this connection the Chairman of the Argentine commission points out that if regular traffic by the railway is to be restored and maintained, the present commercial treaty between the two countries, which is due to expire in June this year, will have to be amended in some of its provisions, especially those relating to the Customs tariffs, the prohibitive duties levied on the importation into Chile of Argentine produce, particularly cattle, being the primary cause of the temporary suspension of the railway service from April to December, 1932.

The Argentine Railways and Exchange

The Argentine Minister of Finance, Dr. Roberto M. Ortiz, has issued instructions to the effect that the remittance of funds by the railway companies during the present year, as authorised by the Exchange Control Board, shall be liquidated by the Central Bank at the rate of \$15.75 pesos to the pound sterling, in accordance with the concession recently made by the Government in this connection.



Sketch map showing route followed by the proposed trans-Saharan-Cameroons-Congo railway

THE REPAIR AND RECONSTRUCTION OF METAL FOOTBRIDGES

A description of various methods actually employed in repair and reconstruction work without delay to rail or foot traffic

By R. D. G.

FEW overbridge structures suffer more severely from the fumes and other effects of locomotive blast than metal footbridges. Though many that originally had no smokeboards have had these added, the latter do not prevent smoke action upon these bridges entirely. In industrial areas also, the corroding of such bridges is caused to a serious extent where rain water, laden with acid or other fumes dissolved from the air, lodges on the iron or steel work.

There is often scope for ingenuity in doing the repairs without stopping the use of the footbridge, and without interfering with rail traffic. On a certain footbridge of 68-ft. span across five tracks, inspection showed that the bottom flanges were very badly corroded, and that the lower ends of the lattice bars, and the diagonal bracings under the floor had practically disappeared. To cut away portions of the bottom flange on such a span would have involved propping, with blocking of lines, and probably single line working. It was therefore decided

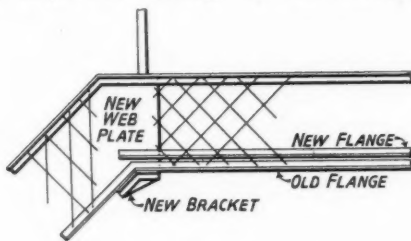


Fig. 1

to take advantage of the fact that the girders were deep relatively to their span, which meant that some loss of depth could be afforded. It also had the merit of improving the clearance under the bridge. Two new bottom flange angles were fitted on, and riveted to each girder before disturbing anything else. They were put on at such a height above the old flange as to make exactly one more step on the stairs when the job was finished. The chief difficulty was in making a good end anchorage for them, and this was done by putting a $\frac{1}{2}$ -in. web plate in at the cranked part of the girder. To enable this to be done safely, as it involved temporary removal of part of the top flange plates, stiff brackets were fixed under the knees of the girders, which places required strengthening in any event, as they were badly corroded (Fig. 1).

Once these were on, the plates could be got in and the new bottom angles riveted to them. The ends of the severed lattice bars were then also fixed to these plates. Minor difficulties arose because of the overhead bracings and gas pipes and electric cables, all of which had to be moved temporarily. When the new flange angles were ready, the old decking was transferred to them, permitting the old flanges and bottom ends of the lattice bars to be burnt away by the oxy-acetylene burner. Flange plates were then riveted to the underside of the angles, all holes having been drilled previously, the new cross bracings were fixed, and finally the outriggers were riveted up. The footbridge was kept open for pedestrians throughout, and there was no interference with rail traffic.

An advantage of the old style of wrought iron lattice

girder footbridge with multiple intersections of the lattices is that, because the bottom flanges are invariably built up in short lengths not exceeding about 18 ft., it is possible, provided the bridge is not heavily loaded, to remove a section of flange on one girder at a time, putting on the new flange immediately afterwards. Discretion must of course be used in selecting suitable places at which to cut the flanges, whether angles only, Ts only, or a combination of these with plates. A good final joint arrangement must also be achieved. Less liberty must be taken with the top flanges, on account of the liability to buckling.

A common design of the older footbridges is to have two bottom flange angles with a vertical plate, usually called a V plate, between them. The lattice bars are fixed to this plate, and a common fault is that a long end of bar is left beyond the last rivet. Corrosion starts under this and gradually forces it away from the plate, which in time may become holed under the loose end of the bar. It is good practice, when repairs are in hand, to cut off the superfluous metal.

Local circumstances often indicate a method for getting repairs done, and one such example may be noted. This footbridge gave access from the street to an island platform, but also had an extension to a parallel street, so forming a footbridge for use when a level crossing was closed across the road. Advantage was taken of the fact that one span could be closed without inconvenience, as most people prefer to wait for crossing gates to open, rather than cross a bridge. This span was therefore taken down by means of a pole derrick, laid on a suitable piece of ground near by, the old bottom flanges removed, new ones fitted, and it was then re-erected by means of the derrick.

Reconstruction Using Old Bridge as Falsework

Sometimes a footbridge is found to be beyond repair; that is, a new one would be cheaper than repairs. The staircase may be good enough, but the span may have to be renewed. The new span is generally erected with a crane, but in some cases a pole may be used. One example may be quoted in which the span was between station buildings, the staircases being stone steps in brickwork. The old bridge was badly corroded, and a renewal was required. The span was lifted up sufficiently for the new floor joists to pass under it. The new lattice girders had previously been assembled, and then taken apart. Using the old span as falsework, the new bridge was erected piece by piece round it. When it was complete,

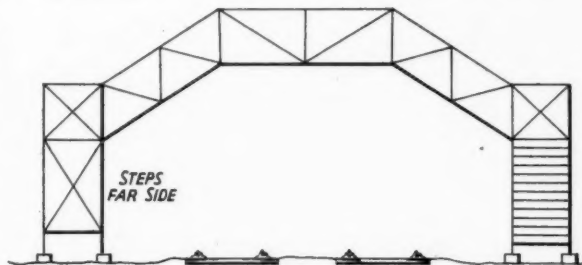


Fig. 2

the old span was cut away by the oxy-acetylene burner, leaving the new one in position.

Advantage was taken of the special design of one particular footbridge, to erect the whole structure without the use of a crane, and to complete the job by working between trains; the new structure was to replace a timber one destroyed by fire. The concrete foundations had been put in on week-days, and the bolts connected in solid, after checking by careful measurement with a steel tape. The type of bridge is shown in Fig. 2, and the fact that all members were of stout angle section decided the method of erection. Except that each staircase girder was assembled, the steelwork was otherwise sent piecemeal to the site, each separate piece previously having been marked to correspond with the drawings. The erection was done on a Sunday, between trains, use being made of a ballast train working in the section to run out two wagons of steelwork. They were at the site at 7.55 a.m. and were unloaded by 8.55 a.m. By 9.45 a.m. all the stanchions had been erected, followed by the bracings. The cantilever portions of the top girders were erected by means of a very light pole, as the weight of each portion

was only about 5 cwt. The down side cantilevers were in position by 1.35 p.m. and the up side soon afterwards. The top horizontal portion of the bridge was then placed, piece by piece, by men standing on the cantilever ends. A little difficulty was experienced in getting the first bottom bar in, owing to the deflection of the cantilevers, but once this was in place, the remainder followed easily. The rest of the work, including stair treads, decking, hand-railing and wire netting, also fixing of smokeplates, was done on week-days, between trains. The two special features of the design which enabled this method to be adopted were the stiff sections provided for all flange and web members, and the cranked form of the upper portion of the bridge. It would not be applicable to the type of bridge in which there is a horizontal spin between the inside columns.

Electric welding offers great possibilities for the repair of footbridges, but does not compete with the erection of a new bridge by site bolts or rivets, in view of the comparatively small number of these. In any event there still remains the problem of getting the material into position.

DRYING UP THE ROADBED

Comprehensive programme carried out by the Pennsylvania Railroad

IN recognition of the primary importance of adequate drainage to the economical maintenance of smooth-riding track, the Pennsylvania Railroad began a programme of extensive drainage in 1928. The first part of the work, which is described in the *Railway Age* of November 9 last, consisted largely of reshaping the main drainage ditches in cuttings and, in flat country, at the side of the line. By 1930 practically all the worst conditions had been cleared up. Most of the cuttings treated were relatively short and shallow, but many were more than a mile in length, and some were as deep as 70 ft. and required 25,000 to 75,000 cu. yd. of excavation.

Throughout most of this work standard ditches were provided, with side slopes corresponding to the angle of repose of the material encountered, but where the track appeared to be particularly wet deeper ditches were provided in an effort to draw the water from the roadbed. Wherever the natural slope of the ground above the cuttings was towards the tracks, ditches of ample size were provided behind the top edges of the slopes, draining either towards the end of the cutting or over paved lateral drains into the main side ditches. The slopes were, as a rule, seeded with a mixture of deep-root grasses, and in some places the seeded areas were covered with a layer of cinders, which had been found effective in preventing wash and in enabling the seed to take hold. Elsewhere, mushroom soil was spread to stimulate the seeds. At many points where conditions indicated the possibility of wash, honeysuckle plants were set to help to stabilise the slopes.

Generally the heavier widening and ditching work was done under contract because of the special excavating equipment required, and most of it was done without the use of ballast trains. Caterpillar mounted cranes and draglines were used and the excavated material was either spread behind the cuttings or removed by motor lorries. Where space permitted, narrow gauge wagons were used. In a number of cases, little used sidings were taken up to make room for an adequate ditch without incurring the expense of widening the cutting and purchasing extra land.

On the high-speed Fort Wayne branch, traffic was formerly hampered by several permanent speed restrictions due to the difficulty of keeping a good top over wet places, in spite of a maintenance cost eight times the

normal. The country traversed is flat but the subsoil consists largely of impervious blue clay of low stability when wet. Improvements were effected by laying perforated corrugated pipes at right angles to the tracks at intervals of 20 to 30 ft., discharging into side ditches or submerged drainage pipes.

Another interesting case was the drainage of a clay embankment approach to a bridge near Marshall, Ill., which was continually having small slips. This was remedied by constructing systems of drainage in it, using perforated and non-perforated pipes of diameters varying from 8 in. to 36 in. These systems projected laterally as well as upward in the fill, and after settlement due to the drying out of the embankment had finished, severe sliding ceased.

Elsewhere, a continuous stretch of 53½ miles of relatively flat double track was lifted 2½ ft. first on 18 in. of ashes and later on 12 in. of crushed rock put down in successive lifts of 8 in. and 4 in. and thoroughly tamped with power ballasters.

Between Philadelphia and Washington, D.C., a modified system of cross-drains has been put in. This was done by means of sloped cross trenches at water pockets, in which a 12-in. layer of cinders was placed 24 in. below the lowest point of the pocket and covered by a treated timber mat. Where deep open side ditches would create an unstable condition, treated wood box drains generally large enough to permit the passage of a man for cleaning, were provided beneath normal side ditches to collect and carry off the seepage from the cross-drains.

While the main work was proceeding, the general maintenance of ditches and drains was carried out continually, and more than 2,000 track miles of stone ballast were completely renovated by mechanical means, to ensure free-draining track.

It is difficult to express in figures the saving which has accrued from this extensive drainage programme, inasmuch as improved and faster running has been obtained in addition to easier and a higher standard maintenance being the result. For the last three years total expenditures for track laying and surfacing on the road have been only about one third of what they were in 1928 and 1929, a reduction of about \$14,000,000 a year.

AUTOMATIC TRAIN CONTROL IN GERMANY

Further developments of the inductive system

IN our issue of September 7, 1934, we published an illustrated account of the inductive system of automatic train control used on a number of important main lines of the German State Railway, which were shown on a map accompanying the article. It was stated in conclusion that certain improvements and alterations were contemplated as a result of the experience gained with the trial equipment, and we are now able to publish some additional information by permission of our contemporary the *Zeitschrift für das gesamte Eisenbahn-*

in the rear of which a track magnet is placed to act as an approach speed detector and controller. Track magnets are, of course, also placed at the distant and home signals. In the diagrams there is another distant signal adjacent to the home signal and acting as a repeater of the starting signal at the other end of the station, in accordance with the practice now become fairly general in Germany, and there is in consequence a second track magnet at that spot acting in conjunction with it.

Immediately the front of the train passes the distant

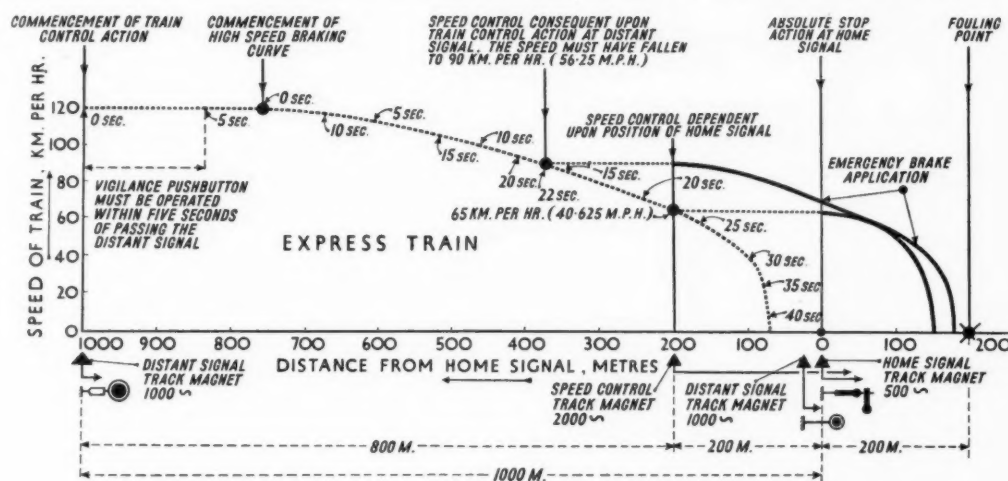


Fig. 1—Braking curve for express train. Vigilance handle used at distant signal and speed controlled 22 seconds later

Sicherungswesen, in which the latest apparatus has been described by Herr Krauskopf.

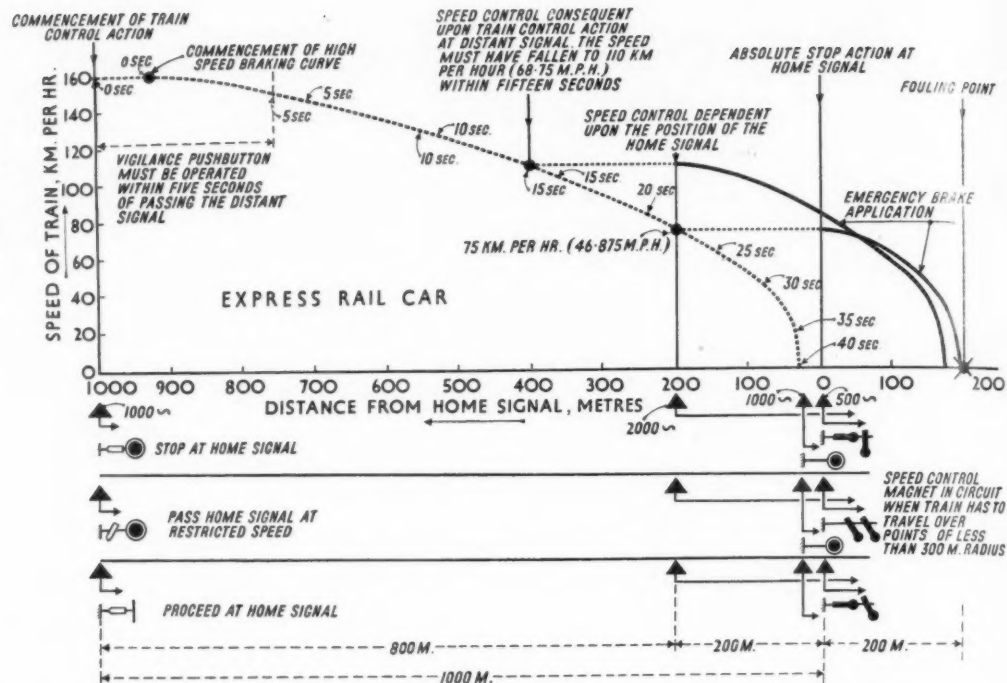
The system adopted by the Reichsbahn comprises the use of a so-called vigilance push-button, or handle, with the aid of which the driver signifies that he has duly observed an adverse distant signal, combined with a speed control at a pre-determined point 200 m. (218.72 yd.) in the rear of the home signal and an absolute stop action at that signal. In this way it is sought, with the minimum of track apparatus, to meet practically all conditions encountered in regular service, and guard against most of the effects, certainly the worst effects, of disregard for signals. The general principles of the working of the German State Railway system were described in the article above mentioned and need not be referred to again. Experience has led to modifications being made in the time allowed to elapse before a speed control effect, set in action by passing a distant signal at "caution," becomes operative. The three diagrams accompanying this article will enable the action of the latest apparatus to be understood.

In Fig. 1 the braking curves are shown for various sets of conditions affecting an express train which is assumed to pass an adverse distant signal at 120 km. (75 m.) p.h., the home signal being 1,000 m. (1,093.6 yd.) in advance. The fouling point, before which the train must in any case be brought to a stand, is considered to be 200 m. (218.72 yd.) past the home signal, at the same distance

signal at the left of the figure, the apparatus is set in action if the signal is at "caution" and the driver must press the vigilance button within five seconds (550 ft. at that speed), or an emergency brake application will take place. The driver must take steps to reduce the speed of his train in obedience to the signal, and within 22 seconds after passing it must have decelerated at least to 90 km. (56.25 m.) p.h., or the apparatus will again give an emergency brake application. Any such application can be cancelled only by using the special releasing button, the use of which, as well as that of the vigilance button, is recorded on the speed recorder hand. When the train reaches the speed control track magnet, 200 m. (218.72 yd.) in front of the home signal, and that signal has by then been cleared, no further action occurs, but if it is at "stop" the driver must have reduced speed still further to 65 km. (41.25 m.) p.h. to avoid a brake application. If he should continue to drive at that speed and pass the home signal, the absolute stop magnet will bring the train to a stand within the prescribed overlap.

In Fig. 2 the action of the apparatus in connection with a high speed railcar travelling at 160 km. (100 m.) p.h. at the distant signal is illustrated, the various speed controls being marked thereon. Beneath the diagram the positions of the signals are given also for reduced speed, or full authorised speed at the home signal. When the two arm or reduced speed, indication appears at that signal the speed control magnet is effective if points with

Fig. 2—Braking curve for express railcar, vigilance handle used at distant signal and speed controlled 15 seconds later



a radius less than 300 m. (328 yd.) are to be travelled over. In Fig. 3 the emergency braking curves for the case where a driver fails to operate the vigilance button within the 5-seconds interval are also given. An ordinary steam, or electric, express train is brought to a stand about 150 m. (164 yd.) before the home signal, but the high speed railcar over-runs it by a little over 100 m. (109.36 yd.), which is well within the overlap allowed.

Fig. 4 illustrates the electrical connections of the locomotive apparatus. The heavy line indicates the brake valve magnet circuit. The action is briefly as follows:—The distant and home signals are assumed to be at "caution" and "stop" (the contacts in the diagram are marked with the same reference letters as the apparatus which operates them). When the distant signal is passed the relay Hv falls and reverses the contact hv_2 and hv_3 , bringing the time relays Y15(22) and Y5 into action. If the driver does not operate his vigilance button, relay

Y5 opens the brake valve circuit within 5 seconds and the brakes are applied. The de-energisation of the brake magnet closes the circuit to the electric hooter. The opening of contact bm_1 interrupts the feed to all apparatus on one side of it, and the main relay Hv is thus reset to the impulse position. The emergency brake action can be cancelled only by using the special button T1 to bridge the contacts bm_1 . In this case relay Y15(22) does not come into action, being de-energised by the fall of the brake magnet armature.

Should the driver correctly operate the vigilance button Tw within the prescribed time interval the left hand winding of Hv is short-circuited and this allows its armature to return to normal. The re-establishment of its contact Hv₃ again short-circuits the 5-seconds relay Y5, so maintaining the brake valve magnet energised. The other time

Relay Y 15 (22) continues to act, as its circuit is closed over its own contact yO. After the lapse of 22 seconds (15 in the case of a high speed railcar) the releasing relay A is de-energised. Contacts a_1 and a_2 are reversed and the clutch magnet G 110 (90) in the Deuta speed recorder

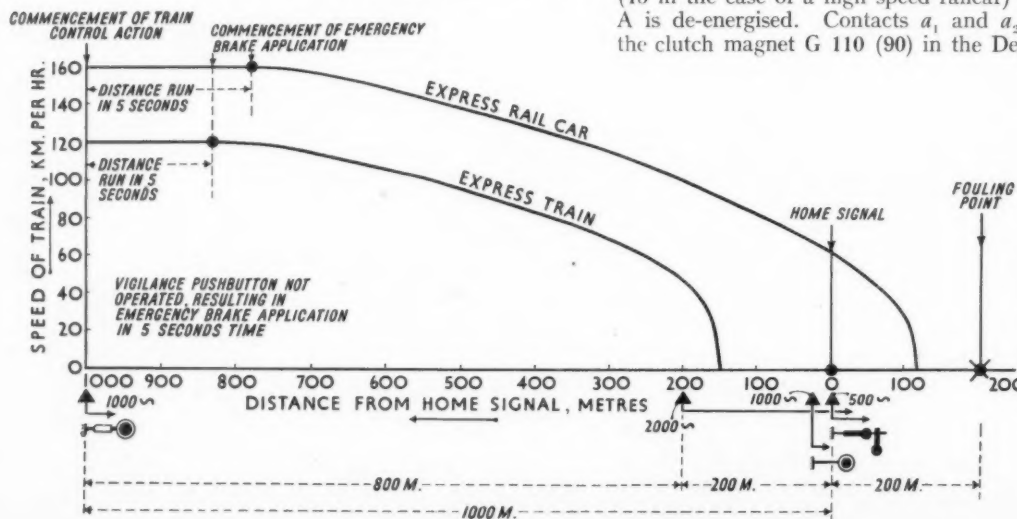


Fig. 3—Emergency braking curves; driver has failed to use vigilance handle within the time allowed

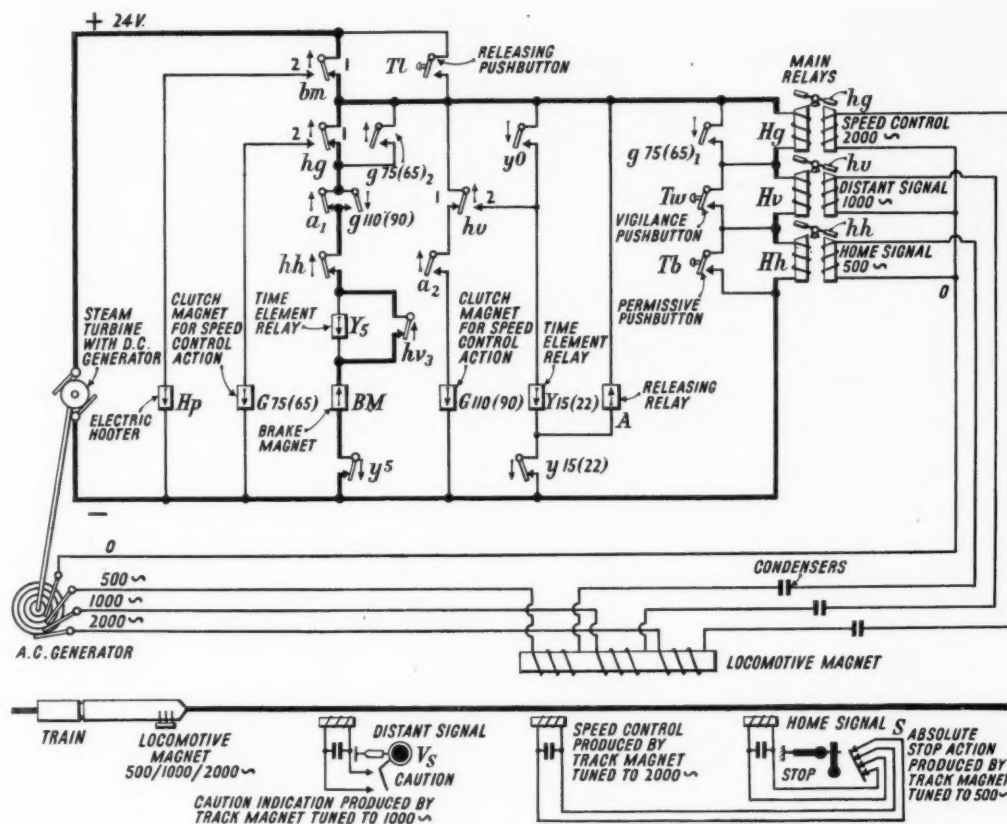


Fig 4—Locomotive and track magnet circuits

is energised, closes its contact $g\ 110\ (90)$ and keeps current on the brake magnet, provided the speed is properly observed, for the time that contact a_1 is open. If the speed is exceeded contact $g\ 110\ (90)$ is opened and the brake valve set in action.

On reaching the speed control magnet in rear of the home signal, main relay Hg is released, contact hg_2 energises clutch magnet $G\ 75\ (65)$ and this closes the corresponding contact $g\ 75\ (65)$. This contact, at speeds below the specified limit, re-energises relay Hg by short-circuiting its left hand winding, and the relay returns so quickly that there is no time for contact hg_1 to set the brake magnet in action. If the speed is too high, contact $g\ 75\ (65)$ is not closed as an insulating piece on the speed recorder comes in between.

If the home signal is passed at "stop" the relay Hh is de-energised when the track magnet is passed over and the brake magnet circuit interrupted directly at contact hh . The hooter also sounds. In order to pass a signal at "stop" under special order, the permissive button Tb must be held down while the track magnet is passed, short-circuiting the actuating winding of relay Hh for the time being, so that the armature does not fall in spite of the reduction in current on the alternating current side.

As explained in our previous article, the various operations are recorded on the Deuta speed recorder, for subsequent checking, and the maintenance staff has portable apparatus for making periodical examinations of the track magnets. The apparatus, except the Deuta recorder, has been designed and made for the German State Railway in conjunction with its train control engineers, by the Vereinigte Eisenbahn-Signalwerke, Berlin-Siemensstadt

and represents the most complete equipment of its kind to be seen on any European railway.

U.S.A. Railway Operation Compared

In 1923 the railways of the United States adopted a comprehensive programme of modernisation and improvement designed to increase the efficiency and economy of their operations. This programme has since been followed, though under difficulties in the last five years due to lowered traffic volume and decreased earnings. How the carriers have succeeded is shown in the following figures covering Class I lines:—

- | | |
|--|---|
| In 1922—The average freight train consisted of 38 cars. | In 1934—This figure had been increased to 46 cars, an increase of 21 per cent. |
| In 1922—Each freight train performed each hour on the average a service equivalent to carrying 7,479 tons of freight for the distance of one mile. | In 1934—This figure had been increased to 11,225 ton miles, an increase of 50 per cent. |
| In 1922—163 lb. of coal were required in freight service to move 1,000 tons of freight and equipment for the distance of one mile. | In 1934—This figure had been reduced to 122 lb., a reduction of 25 per cent. |
| In 1922—17.9 lb. of coal were required in passenger service to move a passenger train car for the distance of one mile. | In 1934—This figure had been reduced to 15.2 lb., a reduction of 15 per cent. |
| In 1922—Payments made by the railways for loss and damage to freight amounted to \$1.11 for every car loaded with revenue freight. | In 1934—This figure had been reduced to 53 cents, a reduction of 52 per cent. |

MEASURED SHOVEL PACKING IN ARGENTINA

By G. N. WILLIAMSON, Chief Engineer, Buenos Ayres and Pacific Railway

SMOOTH running track is of increasing importance owing to the present tendency to higher speeds both for passenger and freight trains, and railway engineers necessarily devote much attention to improved methods for keeping the line in good surface. Some eighteen months ago the engineering staff of the Buenos Ayres & Pacific Railway made a close study of measured shovel packing as practised in other countries in comparison with the beater packing hitherto in general use, their object being

The packing of track with the end trays is carried out in the following manner. A minimum gang of five men including ganger is required, viz., ganger, one man to assist the ganger with boning rods and subsequently to measure the chippings and assist with the trays, one jack man, and two tray men. Two high points on the track at a convenient distance apart are selected by the ganger, and the jack man and two tray men proceed to uncover the shoulder of the ballast for the width of each sleeper down to the level of the sleeper seating between these points (Figs. 9 and 10). A boning rod is fixed at one of the high points referred to and the ganger takes up his position with a second boning rod at the other.

The man assisting the ganger clips the boning shim (Fig. 4) on the rail at the first low sleeper ahead of the ganger and moves the third boning rod on the graduations until the required lift is recorded which is noted in chalk on the rail at the point of observation. The shim

is then moved on to the next sleeper and the operation repeated until the required lift for all the sleepers between the two high spots is noted.

Before any lifting is done the ganger observes and measures with the special calipers any blind slacks (Fig. 8), recording the reading in chalk on the rail opposite the sleepers. The jacks are then placed in position by the jack man, and the track lifted about an inch above its correct level. The other two men who have been removing the ballast at the sleeper ends then take over the trays and load one of them with the amount of chippings corresponding to the lift recorded, allowing for the extra chippings necessary to make good any blind slack.

The empty tray is first inserted (Fig. 5) under the sleeper to remove any ballast which may have fallen in from the boxing in at sleeper sides (this happens only

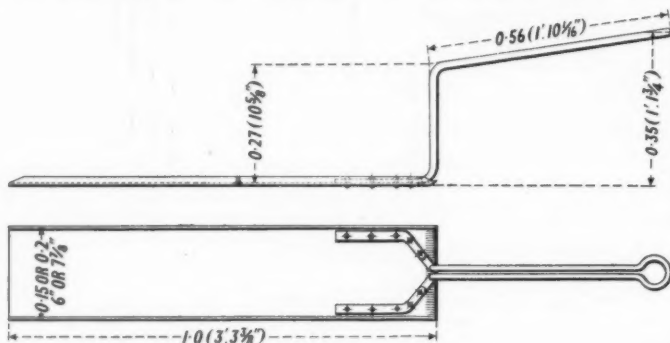


Fig. 1—Tray for end shovel packing

to devise a system which, besides being an improvement on present methods, would likewise lead to greater economies in track maintenance, be readily adaptable to the class of labour available, and applicable to the various classes of ballast existing on the railway.

A number of trays both for end and side packing were designed and tried out in actual practice with varying results and they were finally discarded for those shown in Figs. 1, 6, 7 and 9 which, after extensive trials, were found to meet all requirements. In addition to the trays, other complementary appliances tried out and adopted were a chippings measure (Fig. 2), the contents of which represent 1 centimetre of lift, calipers (Fig. 3) for the measuring of "blind slacks,"* light 5-ton jacks, and a stepped shim for boning (Fig. 4).

* "Blind slacks" are low places in the rail which appear so only under load. They are due to voids beneath the sleepers, and it is the object of this method of packing to measure such voids and fill them up with the exact amount of fine ballast, or chippings, necessary.

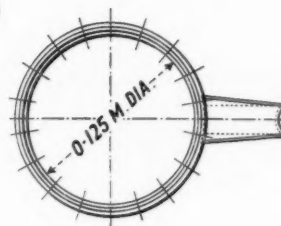


Fig. 2—Chippings measure

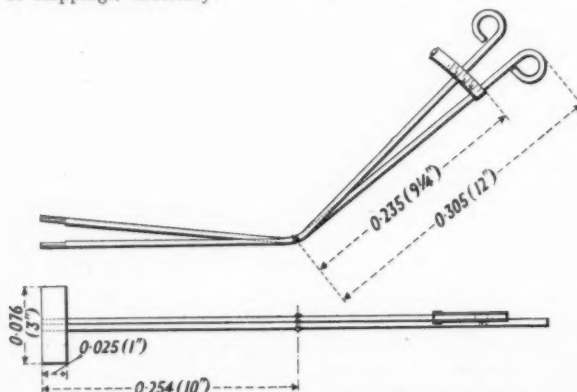


Fig. 3—Calipers for measuring "blind slacks"

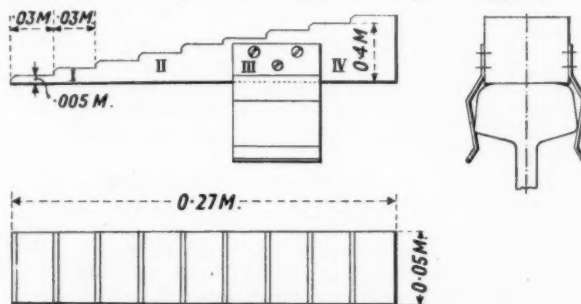


Fig. 4—Stepped shim for boning



Fig. 7—Right and left hand trays for side packing



Fig. 8—Track before raising. Note the "blind slack" in the centre, registered on the rail

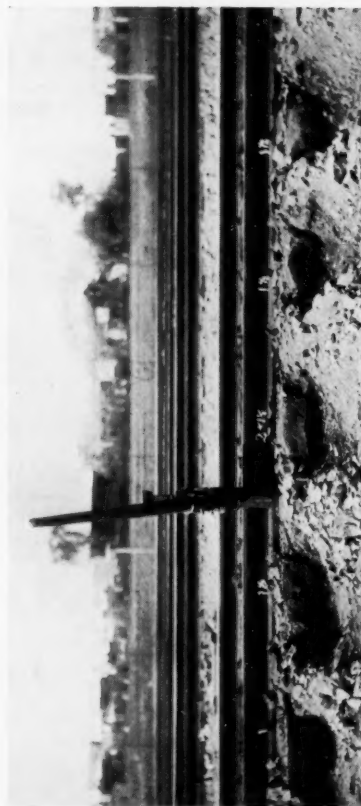


Fig. 9—Track after raising. Lifts registered at each sleeper



Fig. 5—Cleaning out under sleepers with empty tray



Fig. 6—Inserting tray under sleeper with measured amount of chippings

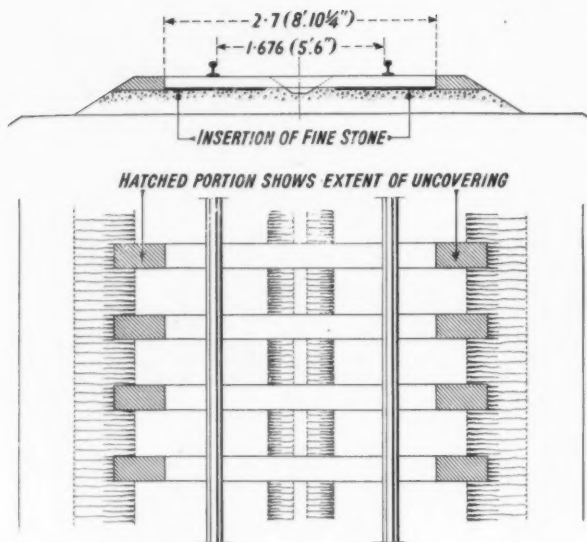


Fig. 10—Showing amount of top ballast to be removed

occasionally), and once it is ascertained that the space is clear, the loaded tray is pushed in (Fig. 6) and withdrawn with short sharp jerks leaving the stone evenly distributed over the sleeper seating. The operation is simplicity itself, and the necessary "knack" is quickly acquired by any ordinary labourer. Once all the low sleepers between the high spots are treated in the same manner, the jacks are lowered and removed.

The covering in at the ends of the sleepers is deferred until two or three trains have passed over the track, after which the surface of the rail is revised, any slight irregularities are rectified in the manner above described, and the ballast at the ends of the sleepers is then replaced.

Where end packing cannot be carried out owing to platform or viaduct walls, bridge girders, point rodding, or other obstructions, the side trays shown in Figs. 7 and 11 are used. These trays must necessarily be inserted from the centre of the track and they are slipped under the rail, centrally to it. Right and left handed trays are therefore required, the requisite adjustment in the handles having been obtained by bending them in opposite directions as shown in Figs. 7 and 11. The method of working with the side trays is as follows:

The stone ballast is picked loose between alternate pairs of sleepers and then scraped towards the centre of the track and towards the ends of the sleepers, leaving these completely uncovered for the length of the tray under each rail. After the requisite lift has been determined and the track jacked up as explained for end packing,

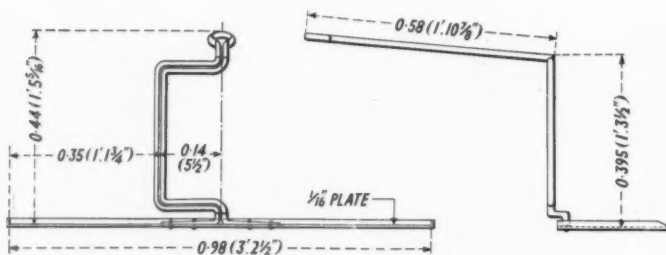


Fig. 11—Tray for side shovel packing

the loaded trays are inserted under the sleepers on each side of the uncovered bay, the stone shaken off and the track lowered again.

Advantages of shovel packing

The following are the outstanding advantages of this method of working in comparison with beater packing:—

- (1) The consolidated sleeper bed is left undisturbed, the exact amount of fine stone chippings required to replace the track in true surface being evenly spread over the already compressed foundation.
- (2) With end packing the ballast between the sleepers is not moved and therefore continues to resist creep as before.
- (3) The stone ballast removed at the ends of the sleepers is cleaned before replacement, thereby improving the drainage.
- (4) Increased output per man-day.
- (5) Full utilisation of all labourers irrespective of age or physique as the work is done without strain.
- (6) The damage which is caused to the underside of sleepers by pick beaters is entirely avoided.
- (7) Increased facility in packing closely spaced joint sleepers, an important consideration, in view of the present tendency towards shorter joint bearings and fishplates.

On stone ballasted tracks the stone used for measured shovel packing is the (granite) chippings which pass a $\frac{3}{4}$ -in. mesh. On clinker and earth ballast either fine screened clinker or suitable dry earth is used, allowance being made in the latter case for shrinkage, this being determined in accordance with the varying classes of



Fig. 12—Monorail trolley for chippings with removable container

earth available alongside the tracks, in the different districts.

To ensure that the fine stone for measured packing is conveniently to hand at any point of a gang section, small dumps of stone are made at every half-kilometre along all the stone ballasted tracks from where it is conveyed to the site of work by means of the small monorail trolley shown in Fig. 12.

The method of packing as described has been extended to the whole of the line whether on stone, clinker or earth ballasted tracks with entirely satisfactory results. The output per man-day has considerably increased, a better top is maintained and the track surfaced by this method definitely keeps in repair for considerably longer periods than that packed by beater.

NEW STREAMLINED LOCOMOTIVE FOR THE PENNSYLVANIA RAILROAD

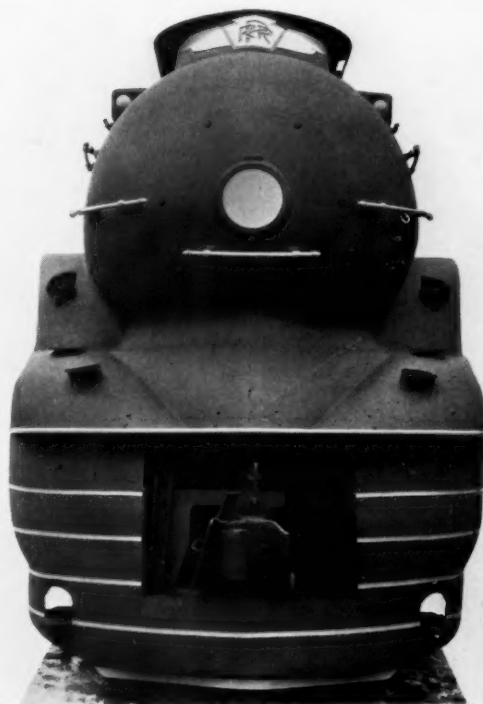
Intensive wind tunnel tests were conducted to determine principal features of design



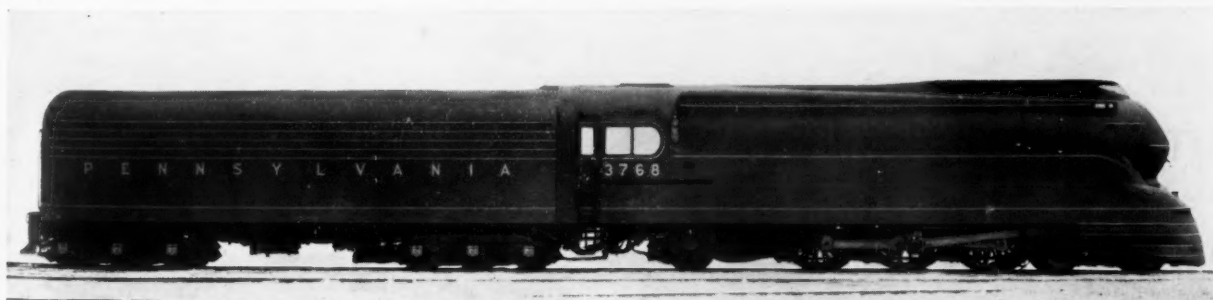
Standard K4s type 4-6-2 locomotive, but with a 25,000-gallon tender

BY the courtesy of Mr. F. W. Hankins, Chief of Motive Power, Pennsylvania Railroad, we reproduce a photograph of the new 4-6-2 type streamlined express passenger locomotive recently completed at the company's works at Altoona. It is one of the standard P.R.R. Class K4s Pacifics, to which an 18,000 gallon tender has been fitted in place of the tender of smaller capacity ordinarily used for this class of locomotive; the streamlining has been developed by the company's engineering department in co-operation with Mr. Raymond Loewy of New York, a widely known authority on streamlining and a member of the railway company's technical advisory staff. In working out the final design, tests with clay models were carried out over a period of months in the wind tunnels of the aerodynamic laboratory of New York University. These models, Mr. Hankins says, were used for the first time in the history of wind tunnel tests, and demonstrated their superiority over wood or other materials by reason of the speed and ease with which the shapes could be changed immediately upon observing the results of each test. The models measure 7 ft. in length, and weigh close upon 100 lb. In all, twenty-four different designs were built, but only four were carried into the final stages of the wind tunnel tests, and it was from these that the ultimate selection was made and complete details worked out.

In the wind resistance tests the models were suspended in the tunnel over a moving belt, and the velocity of the air in the tunnel and the speed of the belt varied to duplicate actual conditions when a locomotive is moving along the track at high and changing speeds. In some of the tests the engineers working on the design entered the tunnel and studied the air currents by observing their



Front-end view of streamlined engine



Pennsylvania Railroad Class K4s Pacific locomotive and 18,000-gallon tender as streamlined

effects upon lengths of silk thread. If the thread remained firm in the slip stream, it indicated that the streamlining was correct. A vibrating thread would show imperfect streamlining, and the design would be accordingly changed experimentally until the trouble was found and remedied. It is claimed to be the most highly perfected and advanced locomotive design yet produced by aerodynamic science for the reduction of wind resistance, and its completion gives the Pennsylvania Railroad three types of streamlined locomotives in operation, *i.e.*, two electric and one steam.

The new engine is intended for high speed through passenger service. At 60 m.p.h. it shows a reduction of more than one-third in wind resistance, whilst at maximum speeds the saving is equivalent to nearly 300 h.p. The locomotive is painted a dark bronze colour with letters and numerals in gold, and the handrails above the running boards at the sides and front are of polished stainless steel. Strips of the same material are also applied

to the boiler along the sides of the engine, and to the tender, to accentuate the streamlined effect. An interesting feature is the smoke deflector, modelled on the principle of an aeroplane wing, and below this on the front is a polished steel keystone with a P.R.R. monogram, the two combining to add to the striking appearance of the front end.

The K4s type, also illustrated in its standard form, except that it is shown with the 25,000-gall. tender fitted to some of the engines of the class in or about the year 1931, has cylinders 27 in. dia. by 28 in. stroke, coupled wheels 6 ft. 8 in. dia., boiler pressure 205 lb. per sq. in., total heating surface with superheater 4,984 sq. ft., and tractive effort 44,460 lb. These features also apply to the streamlined locomotive, which in working order weighs 150 tons 17 cwt. The 18,000-gallon tender fully loaded weighs 129 tons 7 cwt., giving a combined total of 280 tons 4 cwt. The total length of the engine and tender is 95 ft.

Viceregal Tour on Kathiawar Railways



THE photograph we reproduce above, for the original of which we are indebted to Mr. Eric Moore, Locomotive Carriage and Wagon Superintendent of the Bhavnagar State Railway, through the good offices of Nasmyth Wilson & Co. Ltd., Locomotive Engineers, of Patricroft, Manchester, shows the special train used by H.E. the Viceroy of India on the B.S.R. during his recent tour of the Kathiawar States.

The two locomotives, repainted cream colour for this occasion, were built by Nasmyth's to the instructions of

the Consulting Engineers, Messrs. Robert White & Partners, London, S.W.1, and delivered in January of last year. They are of the 4-6-0 type with two outside cylinders 15 in. by 22 in. and coupled wheels of 4 ft. dia.

The leading engine is fitted with O.C. poppet valve gear and Weir feed pump, and the second one has Walschaerts valve gear and piston valves. The engines each develop a tractive effort of 14,025 lb. at 85 per cent. of the boiler pressure (160 lb. per sq. in.).

SOME MACHINE TOOLS AT CREWE WORKS, L.M.S.R.*

Producing Bolts and Pins on the Capstan Lathe

THE capstan lathes which we illustrate were recently installed at the Crewe works of the London Midland & Scottish Railway, and are used for the manufacture of various types of bolts and nuts ranging in diameter from $\frac{1}{2}$ in. to $\frac{7}{8}$ in., from mild steel hexagon and round bars. The $\frac{7}{8}$ -in. dia. hexagon headed bolts are 4 in. long and are screwed to a length of $1\frac{1}{4}$ in. The production time is 13 an hour, and the machines have a turning speed of 93 ft. per min., feed of 160 cuts per

48 to 2,034 r.p.m. is available. The Herbert duo-rate cross slide is fitted, and an instantaneous change from fast to slow feed or *vice-versa* may be obtained.

Grinding Locomotive Parts

We illustrate a new Lumsden surface grinder recently installed at the Crewe works of the L.M.S.R. The machine is engaged on the grinding of various locomotive parts where metal to metal joints are required, such as regulator heads, steam pipe cones, blast pipes, distance pieces, &c. In the illustration it is seen grinding a super-

heater header casting, this component being surface ground over an area of approximately 130 sq. in. The floor to floor time is 1 hr. 20 min. The roughing operation is done with a segmental wheel 12 in. dia., and finishing is done with a periphery wheel 12 in. dia. by 2 in. wide; the machine is designed to remove stock rapidly with one wheel and finish the surface with another wheel while the work is still in the machine. Low pressure hydraulic mechanism drives the table on lubricated vee ways, and all piping, together with the pump, is housed in the bed.

The vertical spindle carries the segmental wheel, and the horizontal one the periphery wheel. The first of these is in the form of a special motor head, and has the wheel mounted directly upon it. The periphery wheel is driven

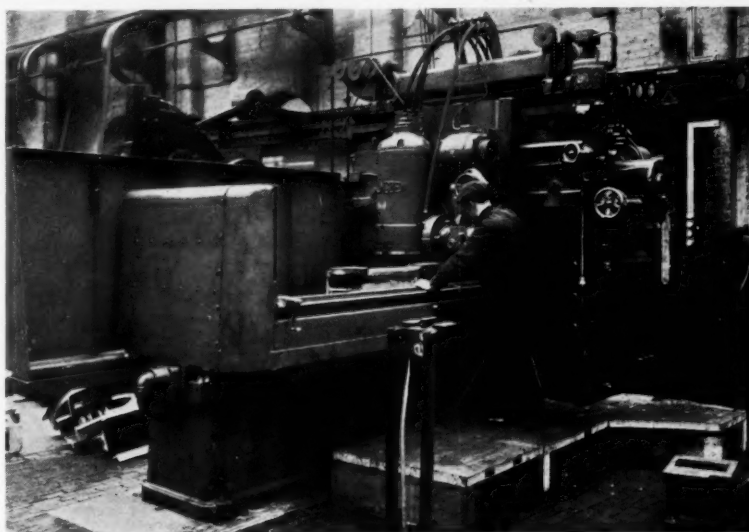
by Texropes from a separate motor. Control is by push-buttons throughout. The wheels can be instantaneously raised or lowered, or traversed in or out. Both cross feed and fine down feed are automatic.



Herbert capstan lathes producing nuts and bolts

in., and screwing speed of 97 r.p.m. Eighteen per cent. high-speed steel tools are used for the work. The lathes are of the Herbert No. 2B capstan type, equipped with all-gear headstock and the makers' air-operated dead-length bar chucks, which have a capacity of $1\frac{1}{2}$ in. An advantage of these chucks is that there is no end movement of the work when gripping, thus making them suitable for work in which end dimensions are important. The chuck mechanism is contained in the main casting, which is bolted to the front of the headstock. The thrust of closing the chuck is taken on a ball bearing of large diameter.

The machines are entirely self-contained, and the spindle is mounted in special precision type roller-bearings; all shafts and loose clutch gears run on ball bearings. The headstock provides six changes of spindle speed, forward and reverse. The machines can be supplied with any one of three speed ranges, high, medium, or low. By fitting a three-speed motor a complete range of 18 speeds from



Lumsden surface grinder at work on a superheater header

* Illustrations reproduced, together with the accompanying particulars, by courtesy of Mr. W. A. Stanier, Chief Mechanical Engineer, London Midland & Scottish Railway.

The Silver Jubilee of the Completion of Boring of the Lötschberg Tunnel

(See Overseas notes on page 857)

On March 31, 1911, the two headings of this nine-mile tunnel met, though only after great difficulties and dangers had been encountered, and serious loss of life had occurred, due to flooding. This entailed a wide diversion of the tunnel alignment, but the North and South headings met just over 25 years ago amid great rejoicings. In the illustration on the right may be seen the Kandersteg or northern portal of the tunnel



Left: The meeting of the engineers in charge of the northern and southern headings 25 years ago

RAILWAY NEWS SECTION

PERSONAL

Lord Wakehurst has resigned his seat on the board of the Southern Railway and the Hon. Clive Pearson, Chairman of S. Pearson & Son Ltd., has been elected to fill the vacancy.

Mr. G. N. Shawcross, M.B.E., is retiring today from the position of Mechanical Engineer, Horwich,



Mr. G. N. Shawcross, M.B.E.,
Mechanical Engineer, Horwich, L.M.S.R.,
1923-36

L.M.S.R. It is interesting to note that he is the last of the seven Mechanical Engineers appointed on the amalgamation of lines forming the L.M.S.R., whose portraits and biographies we published in our issue of January 26, 1923.

Mr. Shawcross joined the former Lancashire & Yorkshire Railway as an apprentice in 1890, and, after holding various positions in Horwich works, was placed in charge of the Testing Department in 1899. Two years later he became Manager of the Forge Department, and was soon afterwards promoted to be Assistant Works Manager. During the war period, 1914-19, he served as Acting Locomotive Works Manager under Mr. G. Hughes, and was responsible for extensive munition work, as well as the ordinary work of the department; he was confirmed as Works Manager in 1919. Mr. Shawcross was appointed Divisional Mechanical Engineer, Horwich, on the amalgamation of the former London & North Western and Lancashire & Yorkshire Railways in January, 1922, being designated Mechanical Engineer as from January 1,

1923, with the final grouping. Mr. Shawcross was awarded the M.B.E. in 1918, and has served as a member of the British Engineering Standards and various other committees. He was closely concerned with labour and staff welfare matters, and has been President of the Technical College and Institute at Horwich since 1925. He was Vice-President of the Institution of Locomotive Engineers 1925-31, is a Member of the Institution of Mechanical Engineers, and was Member of Council (1935) and Chairman, N.W. Branch of that institution (1935-6). In April, 1926, he was gazetted Major, R.E., Engineer and Railway Staff Corps, and is also a F.R.Hist.S. We are indebted to him for assistance in the preparation of several articles on work in Horwich works published from time to time in THE RAILWAY GAZETTE.

We regret to record that Mr. Charles Edward Stanier died at his home, Station Road, Topsham, Devon, on April 23. Mr. Stanier was a son of the late Mr. W. H. Stanier, for many years Chief Stores Superintendent of the Great Western Railway, and a younger brother of Mr. W. A. Stanier, Chief Mechanical Engineer of the London Midland & Scottish Railway. Mr. C. E. Stanier served as a pupil at the Swindon works of the Great Western Railway, first under Mr. William Dean and later under Mr. G. J. Churchward. After completing his pupilage he was engaged in the steelworks office at Paddington and subsequently was employed in the bridge designing office of Dorman, Long & Co. Ltd. From there he went to the Patent Shaft & Axletree Co. Ltd. and was in charge of the firm's Old Park works, Wednesbury. At a later period Mr. Stanier was engaged on bridge designing work in Ireland and on March 21, 1910, he joined the service of the London Underground Railways as Steelwork Assistant in charge of the drawing office. On February 1, 1921, he was appointed Assistant Engineer (Indoor), and on April 18 of the same year became Civil Engineer of the London Underground Railways; he held this post until his retirement owing to ill-health on June 30, 1928. At the time of his death he was 57 years of age. The funeral took place on Saturday last. Mr. Stanier held the degree of B.Sc. (Lond.).

Mr. L. C. Brittlebank, who, as announced in THE RAILWAY GAZETTE of April 10, has been appointed District Goods and Passenger Manager at Chester, L.M.S.R., entered the service of the former Lancashire & Yorkshire Railway at Manchester in 1906. After graduating through the various sections of the

work of the Goods Department, and serving on shunting, goods terminal, mechanical appliances, and other committees, he was transferred to the personal staff of the Chief Goods Manager, where he acted as General Assistant. In 1919, Mr. Brittlebank was selected to take charge of the newly-formed Motor and Cartage Department of the L. & Y.R., and, in addition, assisted in the investigations in connection with the company's application for road



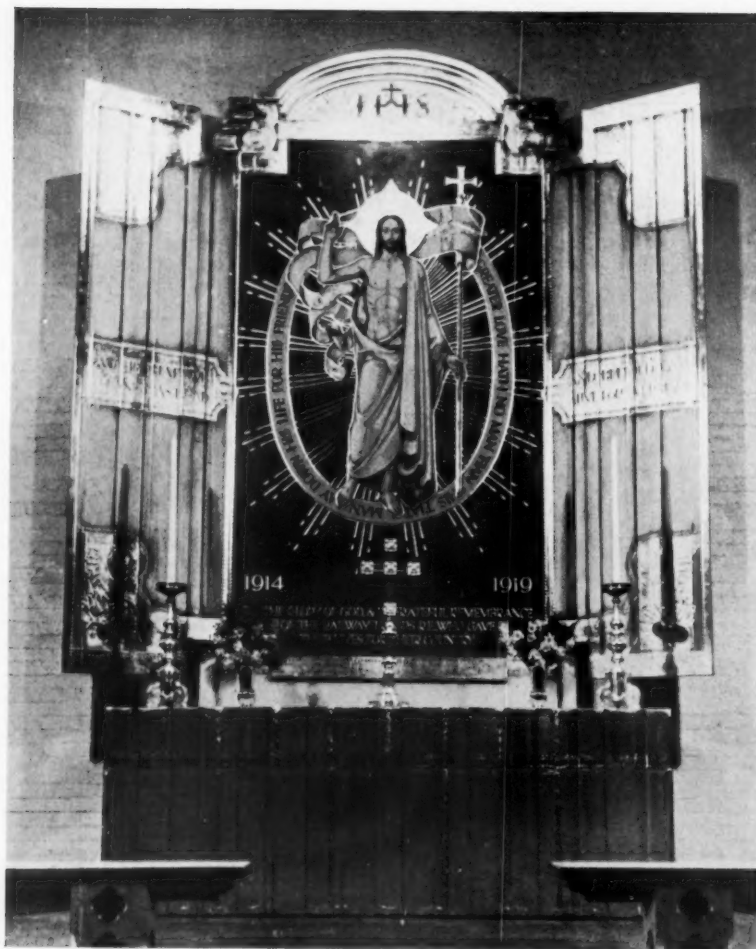
Mr. L. C. Brittlebank,
Appointed District Goods and Passenger Manager,
Chester, L.M.S.R.

powers, and the revision of rates and charges. Following the amalgamation, he was transferred to the headquarters staff of the L.M.S.R. at Euston, and was appointed in November, 1925, Cartage Assistant to the London District Goods Manager. Mr. Brittlebank was appointed Assistant District Goods Manager, Broad Street, in February, 1930, which position he is now vacating to go to Chester, on promotion as District Goods and Passenger Manager.

We are sorry to learn that Lord Ashfield, Chairman of the L.P.T.B., is indisposed.

The annual report of the Railway & Canal Commission states that upon the retirement of Lord Blackburn, the Lord President of the Court of Session has nominated Lord Carmont to be the *ex-officio* Commissioner for Scotland for a period of five years.

Mr. C. J. H. Trutch, who has been Manager of the Diesel Traction Department of Sir W. G. Armstrong-Whitworth & Co. (Engineers) Ltd. since its formation in 1930, is leaving that



The new reredos in the Garrison Church of St. Martin's, Longmoor, to the memory of the Railway Troops, R.E., who fell in the great war (see news article opposite)

position to take up an appointment with Ruston Bucyrus Limited.

L.N.E.R. APPOINTMENTS

The London & North Eastern Railway announces that the following appointments have been made:—

Mr. W. E. Blakey, District Goods Manager at Middlesbrough, to be Assistant Goods Manager, North Eastern Area, in succession to Mr. A. S. Pearson, who [as recorded in our issue of April 3.—*Ed. R.G.*] has recently died.

Mr. R. A. Smeddle, Works Manager, Cowlairs, to be Locomotive Works Manager at Darlington.

Mr. L. Farr, Locomotive Works Manager, Darlington, to be Works Manager at Cowlairs in succession to Mr. Smeddle.

G.W.R. APPOINTMENTS

The following appointments have been approved by the directors of the Great Western Railway:—

F. P. G. Cambridge, Relief Stationmaster, London Division, to be Parcels Agent, Paddington.

A. H. Elsdon, Yardmaster, Old Oak Common, to be Stationmaster, Birmingham (Snow Hill).

W. Bullock, Deputy Stationmaster, Paddington, to be Yardmaster, Old Oak Common.

We learn on reliable authority that Mr. P. H. Maflin, Agent, and Mr. D. B. Trevor, Chief Commercial Manager, H.E.H. the Nizam's State Railway, resigned on April 1. Major Slaughter has been appointed Agent, as from the same date.

Driver W. H. Sparrow, who was in charge of the Royal Funeral train from Paddington to Windsor, retired from the service of the G.W.R. on April 23, after 44 years' service. He rose from cleaner to be the senior driver at Old Oak Common (London) shed, and had 40 years' footplate experience.

Lt.-Col. J. C. W. Madden, Director of the Great Northern Railway (Ireland), whose death was announced in *THE RAILWAY GAZETTE* of January 10,

left estate in England and the I.F.S. valued at £52,361 (£38,329 net).

Sir Hector Munro of Foulis, Member of the Scottish Committee of the L.M.S.R., whose death we recorded in our issue of December 20 last, left estate in Great Britain valued at £17,408.

INDIAN RAILWAY STAFF CHANGES

Mr. I. W. K. Smith has been confirmed as Chief Engineer, E.I.R., with back effect from August last.

Mr. E. R. Fleeton has been appointed to officiate as Deputy Chief Mechanical Engineer, E.I.R., as from March 12.

Rai Bahadur N.C. Ghosh has been appointed to officiate as Divisional Superintendent, E.I.R., as from March 12.

Mr. J. C. O'Neill, officiating Divisional Superintendent, N.W.R., has been granted six months' leave, as from April 15.

Mr. H. Lingard, Chief Engineer, M. & S.M.R., has been granted six months' leave, as from March 31, and Mr. S. S. Elliott officiates instead.

Memorial to Railway Troops, R.E., who fell in the Great War

Dedication of the Memorial Reredos

On Sunday last, April 26, a beautiful reredos was dedicated in the Garrison Church of St. Martin's, Longmoor, to the memory of the Railway Troops, R.E., who fell in the great war. An impressive service was held, which was conducted by the Rev. R. Yale, C.F., Chaplain in charge of the Garrison Church. The service opened with a procession singing "The Saints of God, their conflict past." The lesson was read by the Rev. C. D. Bebb, M.A., Ph.D., F.R.Econ.S., C.F., Methodist Chaplain, Bordon and Longmoor. During the singing of the hymn, "We love the place of God," the memorial reredos, which hitherto had remained closed, was opened and dedicated by the Rev. E. A. Fitch, O.B.E., K.H.C., Assistant Chaplain General, Aldershot Command, representing the Chaplain General who was unfortunately unable to attend.

The Rev. E. A. Fitch also preached the sermon and took as his text 2 Samuel VII 2, "See now, I dwell in a house of Cedar, but the Ark of God dwelleth within curtains." He pointed out how applicable the spirit of the text was to the construction of the Church at Longmoor. It was only five years ago, he said, that a disused forage barn was adapted and dedicated as the Garrison Church. Since that time it had been the endeavour of the whole Garrison, assisted by the Supplementary Reserve Units, to beautify their Church. The memorial reredos was a fitting tribute to the memory of the railway troops who fell in the great war. These troops not only served their country but served civilisation, and had left lasting monuments of their endeavours such as the Palestine and Iraq Railways, for the creation of which they were largely responsible. He ended on a note of hope for the future that in time the Longmoor Garrison Church would become an even more worthy spiritual home of the railway troops of the Royal Engineers in much the same way as the Garrison at Woolwich was the spiritual home of the Royal Artillery, St. George's, Aldershot the spiritual home of the Royal Army Service Corps; and the Wellington Barracks Chapel the spiritual home of the Brigade of Guards. The service ended with the singing of the hymn, "O Valiant Hearts," followed by the "Last Post" and "Reveille" and the "National Anthem." The "Last Post" and "Reveille" were sounded by the trumpeters of the 2nd Medium Brigade, R.A., stationed at Longmoor, whilst music throughout the service was rendered by the mounted band of the Royal Artillery, Aldershot.

The service was held in the presence of a representative gathering of Regular, Retired, and Supplementary Reserve officers and men. Some 200

troops of the Longmoor Garrison, drawn from the 2nd Medium Brigade, R.A. and R.T.C., R.E., attended the service and afterwards marched past General Hon. Sir J. Francis Gathorne-Hardy, G.C.B., G.C.V.O., C.M.G., D.S.O., A.D.C., General Officer Commanding in Chief, Aldershot Command. Amongst other distinguished guests were the following:—

Serving Officers: Gen. Hon. Sir J. Francis Gathorne-Hardy, G.C.B., G.C.V.O., D.S.O., A.D.C., G.O.C. in C., Aldershot Command; Maj. Gen. M. G. Taylor, C.B., C.M.G., D.S.O., M.G. i/c A. Aldershot Command; Maj. Gen. A. Brough, C.B., C.M.G., C.B.E., D.S.O., Director of Mechanisation, War Office; Brigadier C. A. Bird, D.S.O., Chief Engineer, Aldershot Command; Brigadier P. J. Mackesy, D.S.O., M.C., Commander 3rd Infantry Brigade; Lt.-Col. H. N. H. Williamson, D.S.O., M.C., R.A., O.C. Troops, Longmoor.

Retired Officers: Maj. Gen. Sir Sidney D'A. Crookshank, K.C.M.G., C.B., C.I.E., D.S.O., M.V.O., Colonel Commandant, R.E.; Maj. Gen. Sir Dudley H. Ridout, K.B.E., C.B., C.M.G.; Maj. Gen. C. G. Fuller, C.B., C.M.G., D.S.O.; Brig. Gen. Sir H. Osborne Mance, K.B.E., C.B., C.M.G., D.S.O.; Col. G. A. P. Maxwell, C.M.G., D.S.O., M.V.O., M.C.; Col. S. F. Newcombe, D.S.O.; Lt.-Col. J. A. A. Pickard, D.S.O.; Lt.-Col. E. Woodhouse, Ministry of Transport; Major E. M. Sinauer, M.C.; Major W. J. Ross, O.B.E.; Major C. H. Edmonds; Mr. E. J. Hunt.

Railway Officers: Brig. Gen. Sir Harold B. Hartley, C.B.E., M.C., M.A., F.R.S., Vice President, L.M.S.R.; Mr. W. A. Stanier, Chief Mechanical Engineer, L.M.S.R.; Mr. R. A. Riddles, Principal Assistant to C.M.E., L.M.S.R.; Lt.-Col. V. M. Barrington-Ward, D.S.O., Superintendent, L.N.E.R.; Lt.-Col. R. Carpmal, O.B.E., Chief Engineer, G.W.R.; Mr. A. C. Cookson, Stores Superintendent, G.W.R.; Lt.-Col. Gilbert S. Szlumper, C.B.E., T.D., Assistant General Manager, Southern Railway; Mr. J. A. Kay, Editor, THE RAILWAY GAZETTE.

Serving Officers—Supplementary Reserve, R.E.: Major F. Holland, R.E. (S.R.), O.C., 152 (G.W.) Railway Construction Coy.; Captain W. J. Scott, R.E. (S.R.) and Lieut. V. R. Illingworth, R.E. (S.R.), 152 (G.W.) Railway Construction Coy.; Major E. C. Cookson, R.E. (S.R.), O.C., 151 (G.W.) Railway Construction Coy.; Captain R. H. Edwards, R.E. (S.R.), Lieut. C. M. Field, R.E. (S.R.), and Lieut. E. J. M. Matheson, R.E. (S.R.), 151 (G.W.) Railway Construction Coy.; Bt. Lt.-Col. R. Tandy, R.C.S. (S.R.), O.C. No. 2 Coy. (L. of C.) (L.M.S.) Signals Coy.; Bt.-Colonel H. A. Short, M.C., O.C. H.Q. Rly. Stores Group, Southern Railway; Captain L. T. M. Knotts, R.E. (S.R.), Lieut. N. E. V. Brady, R.E. (S.R.), and Lieut. A. H. Cantrell, R.E. (S.R.), 155 (S) Rly. Stores Coy.

After the service the guests were entertained to luncheon in the R.E. Officers', the sergeants' and sappers' messes. After luncheon in the officers' mess, the Commandant, Lt.-Col. J. P. S. Greig, R.E., welcomed the guests, explained how the scheme for the memorial was conceived by Colonel L. Manton, D.S.O., O.B.E., the late Commandant, and then called upon Major C. A. Langley, M.C., R.E., the R.E. Churchwarden, to give some particulars of the reredos and of the policy for the future. Major Langley, in the course of a short speech, explained how the memorial was erected as a tribute from all ranks of the R.T.C., R.E., to their comrades who fell in the great war. It was his hope

that this memorial would be an inspiration to the railway troops, regular and S.R., both of the present and future generations to follow the fine example of their comrades if ever called upon to do so. He then touched on the problem of designing the reredos. The architect was confronted with the alternatives of either designing down to the present barn-like features of the Church, or of looking further ahead and envisaging the Church as it was hoped one day that it would become. The latter scheme was adopted as being the only way of providing a fitting memorial. It was quite clear that structural alterations would be necessary, and a plan to co-ordinate all future improvements and additions to the church had therefore been put in hand. A scheme in this connection which might appeal to many was the provision of four windows, each representing one of the railway companies which provide the personnel of the S.R. Units. Such a gift would be greatly appreciated. However, before launching out on a large scheme on improvements, it was felt that the Railway Training Centre should do its share first, and a memorial to those comrades who fell in the great war seemed to be the most fitting and proper way in which an appreciation of their wonderful work and devotion to duty could be shown.

After luncheon, a number of guests visited the workshops, running shed, and signal school of the Railway Training Centre and saw the many improvements which had been carried out in the past few years. It may interest many readers to know a little of the history of the Garrison Church at Longmoor. Prior to the dedication of the Church, Divine Service was held in the dance hall adjoining the Church of England Institute, whilst the barracks consisted of a number of huts, many of which had been erected shortly after the Boer War. Thus there was no proper setting in this home of the railway troops for a memorial to their comrades. With the provision of a permanent Church, the situation became changed. When the Church was first dedicated it was furnished with the bare necessities. A harmonium provided the music, and choir stalls and pulpit were in plain deal. Later an organ was lent in perpetuity by the C.E.S.S.A.I., and gradually oak choir stalls, pulpit, lectern, and pew fronts were added. Then, by fortunate chance, the opportunity arose for the presentation of the memorial reredos. Now the stage has been reached when the members of the local garrison feel that they are in a position to appeal to all who are interested in Longmoor to make the Church a worthy shrine for the past, present, and future generations. The plan for improvement includes in the first instance structural alterations of the roof, Altar rails, font, and windows, whilst in the future it is hoped that a chancel screen and side chapel may be added. All those

interested in further developments of the Church are asked to communicate with Major C. A. Langley, M.C., R.E. Railway Training Centre, R.E., Longmoor Camp, Hants.

The Reredos

The reredos, of which we reproduce a photograph on page 872, was designed by Mr. Martin Travers, A.R.C.A. (Arch. Lond.), of Colet Gardens, London, and takes the form

of a triptych. The centre panel contains a life-size figure of the Risen Christ with hand upraised in blessing. Around the Figure are the words "Greater love hath no man than this that a man lay down his life for his friends." At the foot of the panel is the memorial inscription "To the Glory of God and in Grateful Remembrance of the Railway Troops, R.E., who gave their lives for their country," surmounted by the dates 1914-1919. In the centre of the side panels is the text

"I am He that liveth and was dead, Behold I am alive for evermore." In each corner is carved the R.E. grenade and motto "Ubique"—a symbolic idea not only representing the Corps of Royal Engineers, but also the flaming torch of Christ spreading light throughout the world. The background of the centre panel is enriched with red and gold, whilst the side panels are in ivory and gold. The whole scheme is completed with a red and gold Altar frontal, silvered wood candlesticks, and cross.

Railway Air Services 1936 Programme

Railway Air Services Limited has now announced its plans for developing its services during the coming summer season. From Monday, May 25, onwards the R.A.S. fleet, to which two four-engined and four two-engined De Havilland machines are being added, will fly daily over 14,000 route miles. The aggregate mileage to be flown over all the routes by the 62 regular daily services during the summer months will be more than 1,000,000 miles, as compared with 600,000 miles in 1935.

The main trunk London-Belfast-Glasgow service, operating from

Croydon, remains unaltered, the schedule being regulated largely by mail consideration. The Liverpool and Manchester to Isle of Man Royal Mail service, however, is being considerably accelerated. Faster and larger machines will enable a saving of 50 min. in the journey time between Manchester and the Isle of Man. Other improvements in this area include the inauguration of an Isle of Man to Leeds and Bradford service, and a new direct service in the afternoons from Manchester and Liverpool to Belfast. Belfast will also be provided with an extra service to Glasgow, and from both Glasgow and

Carlisle there will be new direct routes to the Isle of Man. In the far north it is hoped to connect Glasgow with Perth and Inverness.

In the West important modifications have been made in the routings around Cardiff, which in future will serve as the northern terminus for the services to Torquay and Plymouth. In previous summers this route has had an extension north to Birmingham. The link with the Midlands, however, is now being maintained by way of an air-ferry across the Bristol Channel from Cardiff to Weston-super-Mare and Bristol. At Bristol connections will be made with the Manchester - Liverpool - Birmingham - Bristol - Southampton - Isle of Wight-Shoreham (for Brighton) trunk route. In this latter service the routing along the south coast has been amended since last summer to replace the call at Portsmouth with one

at Ryde in the Isle of Wight. An entirely new ferry service to the island is that to be operated direct from Shoreham (for Brighton). As was the case last year, the London-Isle of Wight route is being flown by Spartan Air Lines' machines hired by R.A.S. An interesting alteration in the arrangements, however, is the transference of the London terminus from Heston to the new London South airport at Gatwick on the London-Brighton main railway line. Railway Air Services will again co-operate with Jersey Airways Limited, a concern controlled by the railway-associated holding company, Channel Island Airways Limited.

The most intensive services will be those between Manchester, Liverpool, Blackpool, and the Isle of Man, where as many as five or six journeys will be made daily in each direction. In many cases Sunday services will be operated during July and August.

Arrangements have again been made by which passengers with R.A.S. tickets may return by first class railway and steamer services, and, alternatively, railway travellers may return by air on payment of a supplement. The heavy luggage of air passengers can be taken under the railway luggage in advance arrangements. Holders of traders' or ordinary season tickets, available between places covered by R.A.S. routes, will also be allowed a 10 per cent. reduction on the ordinary air fares within the area of availability of their railway season tickets.



Sketch map of the air routes of Railway Air Services planned for this summer

GAUGE CONVERSION OF WEST CLARE RAILWAY PROPOSED.—At a meeting held recently at the Marine Hotel, Kilkee, a deputation was appointed to interview Senator Connolly, Irish Free State Minister for Lands, to enlist his support for the conversion of the West Clare Railway from the existing 3-ft. gauge to the standard Irish 5 ft. 3 in. This light railway is 27 miles long and extends from Ennis to Miltown Malbay; it was opened on July 2, 1887. Before grouping in the Free State, the West Clare also worked the South Clare (Miltown Malbay to Kilkee and Kilrush—26 miles) of which 10 miles were opened on August 13, 1892, and the remaining 16 miles on December 23, 1892. The present suggestion concerns the whole of this 3-ft. gauge system.

A Competitive Traffic Section

This article describes the organisation of the Competitive Traffic Section of the Traffic Department of the Leopoldina Railway (Brazil), and its methods of combating competition, together with recommendations for future transport policy

The following is a digest of the thesis presented at the recent Railway Engineering and Legislation Congress, at Campinas, by Dr. Feliciano de Souza Aguiar, formerly Chief of the Railway Central Accounts Office ("Contadoria Central Ferroviária"), and now Commercial Assistant to the Traffic Superintendent, Leopoldina Railway.

The Leopoldina Railway, one of the Brazilian systems where competition is felt most keenly, has tried to organise its commercial services in such a way as to attain the results recommended both by the practical experience of other railways and by observations gleaned from an intimate study of its own traffic movement.

In regard to merchandise of little commercial value, and consequently carried at low rates, competition does not exist, the latter being limited entirely to high-rated commodities and those which by their volume can be carried remuneratively, through occupying relatively small wagon space. It is particularly intense in the coffee-production zones, owing to the certainty of obtaining return-loads.

It was with the object of combating and, so far as possible, curbing the effects of this competition, that a subdivision of the Commercial Section of the Traffic Department, known as the Competitive Traffic Section (with Commercial Inspectors attached), was formed in 1932.

The Work of the Competitive Traffic Section

The initial work of this new section consisted of the organisation of a commercial record, on the card index system, of the entire railway, so as to have at hand the following information with regard to every station: district, municipality and State in which situated; approximate population of locality; list of ranch-owners (*fazendeiros*), exporters, commercial houses and factories, giving their addresses and species of production, with approximate number of operatives in the case of the latter; banks or banking houses; electric power-stations; theatres and cinemas; commercial associations, workmen's co-operative societies, and so on.

A supplementary record was then made, to indicate, in addition to the productions of the various localities, the names of the business firms situated there, and whether they forward and receive only by Leopoldina Railway, or, if by other means also; what these means are; whether they possess "mileage books" (enabling their representatives to travel, in

accordance with a pre-paid charge, a certain distance by any trains on the system within a certain period, with rebates dependent on the amount of traffic handed to the railway), and if so for how many miles they are available; whether they have any complaints to make, and other relevant data.

The Commercial Inspectors, in their periodical visits to firms, note the above details on the respective cards, which also serve as a guide in all cases where remittance of demurrage or warehouse rent charges is being sought, by showing whether the petitioner is a good customer of the railway. Another card indicates, in all cases of traffic diversion, the means of transport used, the rates charged and the localities served, and by means of it the activities of competitors can be checked and the relative success, or otherwise, of their efforts gauged.

Statistical Organisation of Competitive Traffic Section

So far as traffic statistics are concerned, separate card models are employed by the Competitive Traffic Section, and the details referring to each station are entered on the cards in accordance with the figures remitted by the stations themselves, with the exception of those relating to revenue, when the Accountant's statistics are used.

The principal headings of these cards are the following:—

(1) *Revenue*, showing the earnings in passenger traffic, forwarded and received parcels and luggage traffic, forwarded and received, goods traffic ("local" and "foreign" separated in each case), telegrams and sundries.

(2) *Tickets sold*, showing total issues of first and second class single, return, and excursion tickets, excess fares, mileage-books, season tickets, bed tickets and platform tickets; the total number of parcels and goods consignments (forwarded and received) is also included on this card.

(3) *Parcels, Luggage and Livestock*, showing volume of passengers, luggage, parcels (in seven categories) and livestock (in three categories: cattle, pigs and miscellaneous).

(4) *Merchandise*, this card is drawn up in accordance with the code of the Interstate Commerce Commission, adapted to suit local conditions, and shows the total volume of 60 goods-rated articles forwarded and received; these articles are classified under six sub-headings—viz.:—(a) agricultural and milled products; (b) animal products; (c) mineral products; (d) forest products; (e) constructional materials; and (f) manufactured articles and miscellaneous. A supplementary card shows the volume of goods-rated articles and livestock, but in this case *forwarded only*, and reduced to 20 main headings.

In all these cards, the periods taken for comparative purposes are: any one month in the current year, the previous month of the current year and the corresponding month of the previous year. Similar cards are kept to show comparative total carryings and earnings over consecutive years, and by means of coloured tabs affixed to the bottoms of all these cards it can be seen at a glance whether increases or decreases are being registered. Finally, there is a card which shows the various industries existing in the localities served by each station, the volumes of raw goods and manufactured products received and forwarded respectively, and the means of transport used. Stations are supplied with suitable forms for noting down their daily traffic movements for subsequent transcription to another form and remittance to the head office at the end of the month.

The organisation of the foregoing statistics and data has been very helpful, enabling the railway not only to know its clientele, but also to keep before it the species of goods, &c. which are being diverted. By comparing the forwarded and received figures in each station, it is possible to locate the extent and nature of the diversion accurately, and, by adopting special rates and giving a quick service, to win back some of the lost traffic. The Traffic and Commercial Inspectors assist in the attainment of this objective, by keeping in close touch with the various commercial associations distributed throughout the zone served by the Leopoldina Railway, and by endeavouring to harmonise the interests of both parties.

Endeavours to Serve Clients and Combat Competition

By means of the arrangements known as *ajustes* with road-transportation and navigation companies, and by stipulating the handing to the railway of a minimum monthly tonnage at a fixed charge per ton, successful attacks have been launched against competitors, the latest figures relating to traffic carried between Rio and such vulnerable points as Petropolis, Campos and Itapemirim illustrating the extent of the success of these arrangements. In addition to these *ajustes*, special rates have been put in force for certain specified articles between groups of stations, assuring the railway a fair remuneration in return for rapid and efficient transport. Rapidity being a decisive factor in the regaining of traffic from competitors, urgent steps are taken to prevent goods from remaining more than 24 hours in a station, except through circumstances beyond the control of the railway.

No effort is spared by the Leopoldina administration to serve its clientele—ranch-owners, agriculturists, business firms and others—in the most practical ways, and intense propaganda, by means of letters, circulars, advertisements and handbills, is carried on with a view to encouraging cultivation and

the establishment of industries in the zones served by the railway. Valuable co-operation is also given by the Government School of Agriculture, at Viçosa in the State of Minas Geraes, as regards lessons in preparing the ground and improving crops.

Despite the best endeavours, competition is still rife, due mainly to difficulties made by the fiscal authorities. For example, in the Federal Capital no foodstuff can be delivered without the *visa* of the Public Health Department, the State fiscal authorities and the Consumption Tax (*Imposto de Consumo*) Examiners; in the case of roasted coffee, the licence of the National Coffee Department also has to be obtained; and with livestock the Municipal fiscal authorities have to be present. In short, the railway is subjected to very numerous hindrances which are withheld from the road-haulier, who is also exempted from checks on the weights and species of merchandise carried by his lorries.

Unfair Road Competition

Under equal conditions, the railway does not fear competition: it is confident of victory. What causes most loss, however, is the freight-war carried on by the railway's competitors among themselves; for these people, by continuing to divert traffic in haphazard and uncontrolled cut-throat fashion, and by creating an unsatisfactory and unstable situation, delude commercial firms into the belief that railway freights are exorbitant and into disregarding the organisation and perfection of the latter's services and the incalculable extent to which railways as a whole, with their clearly defined responsibilities, have contributed to the development of the areas they traverse.

The Leopoldina Railway is in the unparalleled situation of maintaining relations with four Governments—the Federal, and those of the States of Rio de Janeiro, Minas Geraes and Espírito Santo—and has to collect the respective taxes and comply with the orders of all these Governments. In 1934 the railway transported 1,569,475 tons of goods, 122,121 tons of parcels and luggage, 28,240,401 passengers, and 47,753 head of livestock; the heaviest goods movements were in coffee, sugar, sugar-cane, firewood and cement, and yet only the first two of these, together with a few manufactured articles, are carried at remunerative rates.

Recommendations for Eliminating Unfair Competition

The following is a summary under this heading:—

(1) An adequate system of defence by the railway companies against competition from other means of transport is now more than ever essential.

(2) This defence can be organised only through an exact knowledge of the extent, origin and *raison d'être* of the competition.

(3) To obtain this knowledge the formation of a special service on the

lines of the Competitive Traffic (Commercial) Section is necessary, and this must be equipped in such a way as to have available at any moment the following statistics relating to every station:—

(a) Capacity and demands of the import and export trade of the locality.

(b) Extent and nature of competition.

(c) Revenue of station and its variation, month by month and year by year.

(d) Volume of passenger, parcels, luggage and livestock traffic, with corresponding variations.

(e) Volume of imported and exported merchandise, category by category, with corresponding variations.

(4) Only by a close examination of these statistics can the railways ascertain the quantity of traffic diverted to other media of transport, the causes of this diversion, and the means of avoiding further diversion and of recovering the traffic.

(5) In combating competition it is essential both for railways and for the authorities controlling them to bear in mind the following factors and to adhere to the principles underlying each:—

(a) Rapidity and security in transport—principally the former.

(b) Door-to-door collection and delivery of goods and parcels, either by the railways themselves or by arrangement with road-hauliers.

(c) With a view to co-ordinating their respective interests and avoiding a rate-war with all its complications, the adoption, by common consent, of equal tariffs from the common starting-point to desti-

nation by two or more railways serving the same locality.

(d) The concession, by Federal and State authorities, of freedom of action, within agreed limits, to railways, enabling them to establish provisionally special competitive rates at short notice, by merely communicating their intention to those authorities, except in the circumstances mentioned in paragraph (c), when the competing railway or railways also must be consulted.

(e) The facilitation and intensification of through traffic arrangements, either by contract or *ajustes*, between railways and other transport undertakings, whether by land or water.

(f) The defining of the civil responsibilities of road-hauliers (in addition to the provisions of the Civil and Commercial Codes) by legislation similar to that which regulates the responsibility of railways.

(g) The holding by railways of frequent meetings between their representatives, with a view to comparing the respective means adopted to combat competition and also the results obtained.

(h) The refusal of the public authorities to allow new roads to be built parallel to railways or to places already served by railways, or to allow improvements to be introduced in those already existing, without first ascertaining whether the service provided by the railways is sufficient for the economic development of the regions they serve.

The foregoing thesis and conclusions, on being submitted to discussion, were approved unanimously by the Congress. Furthermore, it was recommended that the statistical organisation on the Leopoldina should be adopted, *mutatis mutandis*, by other railways in Brazil.

Temporary Closing of Penarth Dock

In an official statement issued last Saturday, the Great Western Railway announced with regret that, in view of the continued decline in coal exports, it had no alternative but to close Penarth dock temporarily on and from Monday, July 6, until further notice. Complete access, however, will continue to be given to the premises in the Penarth dock of the Penarth Pontoon, Slipway and Ship Repairing Co. Ltd., for all vessels proceeding to and from the pontoon in connection with the business of that company, and the tidal berths at Ely harbour will continue to be available.

It will be remembered that a proposal to close the dock in 1932 was deferred in response to the views expressed by local interests in regard to trade prospects, coupled with a generous offer by the Earl of Plymouth to forego for the time being the royalties payable to the Plymouth Estates. Although Lord Plymouth has kindly continued to forego his royalties and every effort has been made to affect economies, the receipts at Penarth have been inadequate to cover the working expenses and a substantial and consistently increasing loss has fallen upon the company.

The total of coal and coke shipped at Penarth dock last year was only 978,000 tons, compared with 2,245,000

tons in 1929, which was by no means a peak year, and the trade is still declining. For all the South Wales ports the quantity of coal and coke shipped has fallen from 29,985,000 tons in 1929 to 20,018,000 tons in 1935, and during the current year there was a further decline of nearly 700,000 tons up to April 5 last, due partly to the sanctions imposed against coal exports to Italy, resulting in a loss of exports for South Wales of from two to three million tons per annum. The present position is that the receipts from all docks are insufficient to cover working expenses and the G.W.R. must therefore reduce the facilities to the minimum required for the traffic to be handled. The G.W.R. statement adds that detailed and sympathetic consideration is being given to the position of the staff who will be displaced, and every effort will be made to effect the change with the least possible hardship to the men.

RAILWAY BUSES IN LIVERPOOL.—Sanction has been given by the North Western Traffic Commissioners to the L.M.S.R. to work a service of express carriages between the Adelphi Hotel, and Prince's Landing-stage, Gladstone Dock, and Exchange station, Liverpool.

Ancillary Businesses of the British Railways

I—Docks, Harbours, and Wharves

Docks, harbours and wharves constitute the largest of the railways' ancillary businesses. In normal times these undertakings make a valuable financial contribution, but the economic depression has been responsible for a serious shrinkage in tonnages and revenue. The total net earnings last year were £506,343, compared with £988,256 in 1929, while tonnages of imports and exports dropped from 18,548,000 and 74,274,000 to 16,226,000 and 54,622,000 respectively.

Particulars of the docks owned by the railways, and capital expenditure incurred thereon, are given below:—

| | Number of places where situated | Length of quay | Capital expenditure |
|-----------------|---------------------------------|----------------|---------------------|
| | | Ft. | £ |
| G.W.R. | 15 | 163,600 | 21,094,010 |
| L.N.E.R. | 24* | 209,692* | 26,028,925 |
| L.M.S.R. | 24 | 91,395 | 10,081,289 |
| Southern | 13 | 49,454 | 13,573,854 |
| Joint | 1 | 1,390 | — |
| Total | 77 | 515,531 | £70,778,078 |

* Including Grimsby docks, which are leased to the L.N.E.R.

The principal docks of the G.W.R. are at Cardiff, Swansea, Newport, Barry, Port Talbot and Penarth, all situated on the Welsh side of the Bristol Channel. They are the natural ports for the South Wales coalfield, and the export of coal has always been their principal function. Patent fuel, iron and steel work, and tinplates are also exported in considerable quantities. The principal imports are iron ore, pit-wood, and mining timber, and iron and steel. Grain and frozen meat are also dealt with at Cardiff, while Swansea has a considerable trade in oil, and is a fishing centre of some importance.

Hull, Grimsby, the Hartlepoons, and the Tyne are the chief dock centres of the L.N.E.R. Hull, with a quayage of 64,063 ft., is the largest of the railway-owned docks, and ranks as Britain's third port. Merchandise of all descriptions is imported through Hull in large quantities, the principal commodities being grain, oil, timber and wool. Chief among the exports are coal, cotton, woollen and textile goods; and the numerous other manufactures of

the great industrial hinterland. Grimsby is the world's premier fishing port, in addition to which it enjoys a substantial general cargo trade. The Hartlepoons import large quantities of timber, and the Tyne Dock is a natural outlet for the North Eastern coalfield.

The largest docks of the L.M.S.R. are at Barrow, where there is a quayage of 19,602 ft., together with warehouse accommodation of 170,000 sq. ft., and a graving dock. Grangemouth, on the south shore of the Firth of Forth, is the East Coast port for Glasgow and the coalfields of Lanarkshire and

Stirlingshire. Garston, on the Upper Mersey, has a large import business in sulphur, copper, manganese, iron and other ores, as well as in timber and bananas. Other important ports of the L.M.S.R. are Fleetwood, the premier fishing port on the West Coast, and Ayr and Troon on the Firth of Clyde.

Southampton is, of course, the outstanding docks centre of the Southern Railway, as well as the most important passenger port of Great Britain. It is used by over thirty of the world's leading shipping companies, and upwards of 530,000 passengers are dealt with annually. A large assortment of merchandise is also handled, predominating commodities being fruit, grain, meat, vegetables, timber, wool, skins and hides. The port of Southampton has been developed on the most up-to-date lines, and £6,600,000 has been expended on the docks extensions, including the new graving dock built for the R.M.S. *Queen Mary*.

Financial Results

Comparative trading figures for 1929, 1934, and 1935 are shown below:—

DOCKS, HARBOURS, AND WHARVES

| Company | Receipts | | | Expenditure | | | Surplus | | | Percentage of surplus to gross receipts | | |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------------|----------|---|------|------|
| | 1929 | 1934 | 1935 | 1929 | 1934 | 1935 | 1929 | 1934 | 1935 | 1929 | 1934 | 1935 |
| G.W.R. ... | £ 3,086,147 | £ 1,974,026 | £ 1,947,783 | £ 2,526,115 | £ 1,885,133 | £ 1,901,100 | £ 560,032 | £ 88,893 | £ 46,683 | 18.1 | 4.5 | 2.4 |
| L.N.E.R. ... | 3,227,996 | 2,647,193 | 2,655,566 | 3,029,729 | 2,495,851 | 2,540,750 | 198,267 | 151,342 | 114,816 | 6.1 | 5.7 | 4.3 |
| L.M.S.R. ... | 965,810 | 871,806 | 905,569 | 1,053,700 | 886,165 | 890,735 | Dr. 87,890 | Dr. 14,359 | 14,834 | — | — | 1.6 |
| Southern ... | 1,187,150 | 1,035,228 | 1,099,985 | 869,303 | 743,883 | 769,975 | 317,847 | 291,345 | 330,010 | 26.8 | 28.1 | 30.0 |

It will be seen that the G.W.R. and L.N.E.R., the two principal dock owning companies, show substantial decreases compared with 1929, while their net earnings last year were even less than in 1934.

The position of the G.W.R. docks is now one of such extreme gravity that the company has had no alternative but to arrange to close Penarth Dock temporarily as from July 6 next. The profit on the great chain of docks owned by this company, upon which over £21,000,000 has been expended in purchase price and capital expenditure since 1923, fell last year to the paltry sum of £46,683, compared with £88,893 in 1934 and £560,032 in 1929. Imports and exports at the South Wales docks last year were 411,000 tons less than in 1934 and 13,523,000 less than in 1929. This serious decrease is due to the adverse effect upon the coal export trade of South Wales of trade agreements and currency difficulties, further aggravated last year by the loss of the Italian market. The position, which is one of grave concern to the G.W.R., formed the subject of an article on "The Future of the South Wales Docks" in THE RAILWAY GAZETTE of March 6.

L.N.E.R. receipts last year showed a small increase of £8,000, but expenditure increased by £45,000, chiefly in respect of maintenance, with the result that the net profit was nearly £37,000 less than in 1934, and £83,000 less than in 1929.

The receipts of the L.M.S.R. docks increased by £34,000 last year, principally under the heads of dock dues on goods, dock railways, and cranes and other services. There were substantial increases in expenditure on maintenance, dredging and operating, but due to a transfer of £31,000 from renewal account, the docks account shows a profit of £14,834, compared with a loss of £14,359 in 1934. This is the first profit shown by the L.M.S.R. dock undertakings since 1923.

Improved Business at Southampton

The Southern Railway Company's receipts increased by nearly £65,000, chiefly under dock dues on ships, and cranes and other services. A corresponding increase occurred in operating expenditure, but only £36,000 was transferred to renewal account, compared with over £68,000 in 1934, with the result that the net profit of £330,010 represented an increase of

£38,665 compared with 1934, and £12,163 compared with 1929.

This was the best result recorded by any of the companies and was due to a remarkable increase in traffic at Southampton, which contributed no less than £34,000 to the increased net receipts. Other interesting facts concerning these docks were increases in ships arriving and departing, 6,222 compared with 5,676 in 1934; in gross tonnage of shipping, 36,025,927 against 33,348,239; in cargo handled, 1,048,003 tons compared with 929,012; and in the number of passengers, 537,355 against 484,074 in 1934. The outlook at Southampton is very promising, and if trade continues to improve there is no doubt that even better returns will be earned in the future.

Questions in Parliament

Metropolitan District Railway Traffic

Mr. Blossom, on April 27, asked the Minister of Transport if he could give the total annual number of trains on the District Railway passing a given point before and after the electrification of the line respectively; and had a train on this line ever jumped the rails and, if so, at what date.

Captain A. Hudson, Parliamentary Secretary, replied.—I am informed by the London Passenger Transport Board that the total number of trains per annum passing Charing Cross station on the District Line in both directions is 362,400 today, compared with 164,000 steam trains per annum before the line was electrified. I understand that there has been no case of a passenger train jumping the rails.

Swinging Doors

Mr. Blossom also asked the Minister of Transport what was the space required between moving trains; at what date was this regulation first instituted; and did it prescribe sufficient space to allow the side swinging doors to open without striking a passing train.

Captain Hudson.—Ministry of Transport inspecting officers normally require a minimum clearance for new passenger lines of 18 in. on running tracks between vehicles of the greatest width likely to be used. Neither this requirement nor the standard 6 ft. adopted in main line construction allows sufficient space for swinging doors to open without striking, but the incidence of accidents from this cause is very small.

Forthcoming Meetings

- May 5 (Tues.)—**International Sleeping Car Company** (Ordinary General), 53 Boulevard Clovis, Brussels, at 2 p.m.
May 6 (Wed.)—**Canadian Pacific Railway Company** (Annual General), Head Office, Montreal, at 12 noon.
May 12 (Tues.)—**Charleroi to the Frontier of France Railway Company** (Annual General), Office in Charleroi of the Nord-Belge Railway, at 12.15 p.m.

Power Signalling at Waverley, Edinburgh, L.N.E.R.

Although the power signalling with which the west end of Waverley station, Edinburgh, is now being equipped will not reach completion for several months, the following preliminary description of what will be the largest such installation on the system is of interest. Waverley station, rebuilt in 1893, is one of the busiest and largest in Great Britain, with 15 bay and four through platform lines, as well as through passenger loops and carriage roads. The mechanical signalling equipment at the West End of the station being due for renewal, the opportunity was taken to consider a comprehensive new signalling scheme. The present working at the West End of the station is controlled from Waverley West box, which contains 204 levers, and other boxes controlling movements between the centre of Waverley station and the entrance to Haymarket are Waverley North Central, Waverley South Central, Princes Street Gardens, and Haymarket East. All five, containing a total of 415 mechanical levers, are being replaced by a single box with a 227-lever power frame.

The new signal box is erected on the south side of the line, in a recess 100 ft. long by 12 ft. wide, and has two floors. The ground floor accommodates the relay racks, relays and cable runs, with a gangway below the interlocking frame giving access to the internal wiring. A small workshop and store for the linemen, and also a central heating chamber, are provided. The first floor contains the operating room, together with mess rooms for the signalmen and linemen, and a small room for the train describing apparatus. The operating room has a central bay window 70 ft. long, giving an unobstructed view of the station yard.

The whole of the signalling will be electrically operated, the existing semaphore signals being replaced by modern multi-unit colour-lights, equipped with efficient side lights for close-up indications. The entrance to the station from each up main line will be controlled by a single colour-light signal, with a route indicator to show trainmen the platform into which they are running. All subsidiary signals will be of the internally illuminated banner type, thus dispensing with the use of coloured lights for shunting. Points will be operated by 110-volt d.c. motors, and the whole layout will be completely track circuited, involving a total of 121 a.c. circuits. Telegraphic block working between Haymarket Central signal-box and the new box will not be provided, but train describers are to be installed between these points. At the present time facing road working is permitted between Waverley West and Princes Street Gardens boxes, the necessary protection being afforded by Sykes lock and block. This working will continue, but special circuiting devices will take the place of the lock and block instruments.

A new feature in signalling work is the use of train describing equipment for rapid shunting, designed to expedite operations when arriving trains have to be broken up and re-marshalled in a very limited time before being despatched south.

The new power frame will have miniature levers with electric interlocking, the whole being enclosed in a teak case having glass inspection panels. Lamp indicators will be provided behind each lever to prove the correspondence of the functions operated with the position of the respective levers. A large diagram of the layout will be erected behind the frame, upon which each track-circuited section will be shown. As these sections become occupied, two red lights will appear, and will remain alight until the track is clear. Also, "train ready to start" indicators will be mounted on the diagram adjacent to each platform. Electricity supply will be taken from the City of Edinburgh Electricity Department at 230 V. 50 cycles, which will be transformed down to 110 V. 50 cycles for feeding the various functions. The supply for the 110-V. d.c. point machines will be taken from a secondary battery, trickle charged from the mains through metal rectifiers.

The new signalling scheme has been developed in collaboration with, and to meet the requirements of Mr. C. H. Stemp, and later Mr. R. Gardiner, Superintendents, Southern Scottish Area. The work is being carried out by the Siemens & General Electric Railway Signal Co. Ltd., under the instructions of Mr. W. A. Fraser, Engineer (Scotland), to the designs and immediate supervision of Mr. A. Moss, Signal & Telegraph Assistant to the Engineer, Scotland.

Parliamentary Notes

London Transport Bill

A clause in the London Passenger Transport Board Bill regarding the rating of certain land proposed to be used for trolleybus routes was struck out on April 23 by the Select Committee of the House of Commons which had resumed consideration of the Bill after the Easter recess. Certain tramways in Middlesex authorised under the Light Railways Acts enjoy a partial exemption from rating. The clause in question proposed to continue such exemption on routes whereon trolleybuses were to be substituted for trams, and evidence was given to the effect that the board would be contributing more to the public revenue by means of the increased licence duty. In a report from the Ministry of Health which was before the Committee it was stated that part exemption from rates had not been granted in respect to trolleybus routes in other districts. The Bill as amended was ordered to be reported to the House for third reading.

NOTES AND NEWS

Improved Passenger Service to Holland.—Traffic between Great Britain and Holland has shown such an improvement in recent months that a daily sailing in both directions between Gravesend and Rotterdam on weekdays has been instituted by the Batavier Line. The new service replaces a thrice-weekly sailing.

British Industries Fair, 1937.—The Department of Overseas Trade has announced that the British Industries Fair will take place next year from Monday, February 15, to Friday, February 26, in London and Birmingham. In addition to Olympia, the department has leased the new exhibition buildings now being built at Earl's Court.

New Rhine Bridges.—Work on two new bridges over the Rhine, one at Spire and the other at Maxau, is being rapidly pushed forward; the bridges were started two years ago. That at Spire is 36 ft. wide, and that at Maxau 78 ft. wide. Both will probably be ready early next year, and are considered of great importance in the development of co-ordinated rail and road transport.

Maps and Plans at L.N.E.R. Stations.—In co-operation with the Director-General of the Ordnance Survey, the L.N.E.R. has now fixed one-inch Ordnance survey maps at 167 of its stations in various parts of the country from Essex to Northumberland; all serve districts suitable for country rambles. In addition, town plans are being exhibited at several of the larger stations in co-operation with the local authorities, and at the moment arrangements are being made for these plans to be fixed at 17 stations.

New Motor Approach to Paddington, G.W.R.—By arrangement with the Commissioner of Police of the Metropolis, the Great Western Railway Company has re-organised the method of approach by private motor vehicles and cabs to the arrival platforms at Paddington station. As from Monday last, April 27, drivers of private motor vehicles and cabs approach the arrival platform roads by way of Bishop's Road bridge (as shown on the accompanying

sketch map) and not, as hitherto, by way of London Street and Praed Street. The routes to Bishop's Road bridge have been suitably signposted.

New Railway in the Congo.—The Congo Light Railways (Chemins de fer Vicinaux du Congo) are building a new narrow-gauge line from Aketi, on the Itimbiri river, eastwards to Gogu, which is on the motor route between Stanleyville and the Nile. The route mileage of this line will be 75.

Conference on Electric Lighting.—Under the auspices of the Electric Lamp Manufacturers' Association of Great Britain Limited, a two-day conference on electric lighting in works and offices will be held at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2, on May 19 and 20. Papers, illustrated by practical demonstration and lantern slides, will be read by authorities on industrial lighting subjects.

Canadian Pacific Earnings.—Gross earnings of the Canadian Pacific Railway for the month of March, 1936, amounted to \$10,680,000, an increase of \$1,164,000 in comparison with March, 1935. In the working expenses of \$9,332,000 there was an increase of \$864,000, leaving net earnings \$300,000 higher, at \$1,348,000. Aggregate gross earnings for the first quarter of 1936 were \$29,284,000, an increase of \$2,846,000, and the net earnings of \$2,828,000 were higher by \$726,000.

Canadian National Earnings.—For the month of March, 1936, gross earnings of the Canadian National Railways amounted to \$14,470,710, an increase of \$629,366 in comparison with March, 1935. Operating expenses (\$13,529,178) advanced by \$783,318, leaving net earnings of \$941,532, which were \$153,952 lower than for March, 1935. Aggregate gross earnings from January 1 to March 31, 1936, were \$40,279,771, an improvement of \$1,909,035, but the net earnings for the quarter were \$404,957 lower, at \$76,741.

Road Accidents.—The Ministry of Transport return for the week ended April 25 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding periods of last year :—

| | Killed, including deaths resulting from previous accidents | | Injured | |
|----------|--|-------|---------|---------|
| England | 96 | (109) | 3,491 | (3,665) |
| Wales | 4 | (7) | 135 | (179) |
| Scotland | 22 | (10) | 349 | (336) |
| | 122 | (126) | (3,975) | (4,180) |

The total fatalities for the previous week were 108, as compared with 102 for the corresponding period of last year.

Soviet Railway Budget.—A sum equivalent to £200,000,000 has been allocated to the Soviet railways for the coming fiscal year, largely through the advocacy of the new Commissar for Transport, Mr. L. M. Kaganovitch. In addition to the construction of new

lines and the supply of new motive power and rolling stock, this allowance will cover the doubling of 1,600 miles of line, including the last stretch of the Trans-Siberian Railway from Habarovsk to Vladivostok.

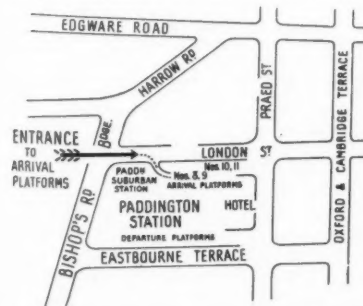
Railway Safety in Rhodesia.—In our issue of January 24 we recorded the fact that the complete absence of fatal accidents to passengers on railways of the U.S.A. in 1935 was believed to be a record in American railway history. It is now announced that a similar freedom from fatalities was enjoyed last year by the railways of Northern and Southern Rhodesia, but in this case the standard was attained for the fourth year in succession. In 1935, the only form of accident of any kind recorded was to a native, who caught his foot between the gangway plates of two coaches, but his injury was not serious. In the four years without fatalities, 1932-35 inclusive, the Rhodesian railways carried 2,655,800 passengers.

Annual Tropical Medicine Conference for Overseas Medical Officers.—It is proposed to hold the Annual Conference on Thursday, July 16, 1936, at the London School of Hygiene and Tropical Medicine, in order that medical officers in industry on leave from the tropics may be able to meet their colleagues and discuss their problems. The main subject for discussion will be the prevention of disease, e.g., the control of malaria and epidemic diseases in the tropics; water supplies; sewage and refuse disposal; housing; the keeping of records; and hygiene generally. Medical officers practising on railways are invited to attend, and those who wish to do so should apply as early as possible to the Organising Secretary, Ross Institute of Tropical Hygiene, London School of Hygiene and Tropical Medicine, Keppel Street (Gower Street), London, W.C.1.

Robins Bolitho G.W.R. Ambulance Competition.—The annual competition for the Robins Bolitho ambulance shield, given by the late Mr. T. Robins Bolitho, took place at Penzance on April 16. The trophy is available for G.W.R. teams in West Cornwall, and there were four entries. Dr. J. G. Morgan, of Liskeard, who adjudicated, said the work was of a high standard, but in some cases could have been speeded up a little. He expected great things of the Plymouth Division. Mr. A. W. H. Christison, Locomotive Superintendent, Newton Abbot, who was supported by Mr. J. F. Anstey and Mr. J. S. Pearson (Assistant Traffic Managers), presided over a repast in the Western Hotel at the close of the contest and announced the result as under :—

| | Marks |
|-----------------|-------|
| 1st Truro No. 1 | 83½ |
| 2nd St. Ives | 79 |
| 3rd Truro No. 2 | 73 |
| 4th Penzance | 64 |

The trophy was presented by Mrs. G. B. Morris, whose interest in the first-aid movement in the locality has extended over many years. Mr. J. H. Tippet (Divisional Ambulance Secre-



Sketch map showing new approach for motors to Paddington station, G.W.R.

tary) referred to the fact that 450 members in the division had satisfactorily passed the examiner during the past session, and he anticipated this being increased to 500 in the coming year.

Transport Services Limited.—A public company under this title has been incorporated with a nominal capital of £130,000, to carry on the business of haulage contractors, coach owners, ship and barge owners, and transport agents. The registered office is at 141 to 153, Kingsland Road, London, E. The Charterhouse Industrial Development Company has the right to appoint one director.

New London Transport Underground Guide.—The new complete timetable guide to all the railway services of the London Passenger Transport Board (to which we made reference on page 731 of our issue of April 17) was placed on sale yesterday, April 30, at ticket offices on the Metropolitan Line, season ticket offices, cloakrooms, and enquiry offices, and also at bookstalls and news agencies in the Central Area. The Metropolitan Line timetable (now included in the new guide) and the London guide (containing brief summaries of the services) are withdrawn from sale as from the end of April. The new guide, which is price 2d., has been produced by Index Publishers (Dunstable) Limited.

Canadian National Railways: Board of Directors.—Mr. Howe, the Canadian Minister of Railways, on Monday moved the second reading in the Canadian House of Commons of the Bill to establish a board of seven directors for the Canadian National Railways in place of the present board of three trustees, outlined in these columns in our issue of March 27. Mr. Howe stated that the present Board of Trustees had failed in co-operative methods. Many employees, he added, regarded the trustees with suspicion because the operating men were under the control of three laymen without the necessary knowledge for dealing with practical railway problems. The Bill contains provision against amalgamation with the Canadian Pacific Railway.

New Hammersmith-Barking Service.—Beginning on May 4, a new service of eight trains an hour will run during peak periods between Hammersmith and Barking via the northern part of the Inner Circle, and will provide for the first time regular through-running between the Metropolitan Line and points east of Whitechapel. The L.M.S.R. and the L.P.T.B. have co-operated in arranging this service largely to meet the greatly increased traffic which has followed housing and factory development at Dagenham, Becontree, and Upminster. Four trains an hour are being diverted from the through service between the Metropolitan Line and the East London Line; in substitution, an increased number of shuttle trains will be worked on the East London Line between New Cross and Shoreditch,

giving exchange facilities at Whitechapel with the main east-west services.

Southern Railway Rating.—The Railway & Canal Commission reserved on Friday, April 24, its decision on the motion by the Railway Assessment Authority and representative local authorities for revision on points of detail of the figures on which the commission had based its reduction of the assessment of the Southern Railway undertaking from £2,180,000 to £1,077,131. The hearing of the motion had occupied four days.

New Railway in Madagascar.—The new railway in Madagascar running inland from the east coast port of Manakara has been completed to Fianarantsoa, the capital of the Province of Betsileo, a distance of 101 miles. A Reuters Trade Service message from Paris dated April 28 reported the opening by the Governor-General of the line. References to this railway, and a sketch map were published on p. 186 of our issue of August 2 last.

Combined Austro-Yugoslav Frontier Station.—Reuters Trade Service quotes Continental papers in stating that, as a result of the successful conclusion of negotiations between the Austrian and the Yugoslav authorities, a new international railway frontier station at Marburg (Maribor) will be brought into service on May 15 coincident with the introduction of the Continental summer timetables. This station, which is on the main line between Vienna and Trieste at the point of junction with the branch to Klagenfurt, is well on the Yugoslav side of the frontier. All frontier control between the two countries on this route will be effected here, and Spielfeld-Strass will no longer be the Austrian customs station. The journey time between Vienna and Trieste will be reduced appreciably.

Transport and its Progress.—At the annual dinner of the Institution of Engineers-in-Charge, held at the Holborn Restaurant on April 24, Mr. E. A. Sandford Fawcett, C.B., the President, stated that, whereas last year the institution paid special attention to municipal engineering, this year its subject was transport. Accordingly, the toast of the evening was that of "Transport and its Progress," which was very ably proposed by Mr. D. A. Bremner, Director of the British Engineers' Association. Sir Charles H. Bressey, C.B.E., Engineer-in-Chief, Survey of Highways Development in Greater London, replied. In his area, he said, the population was now making an average of 440 journeys a year each, and the figure would shortly reach 500. In the education of the public about traffic risks, no one had done better work than the present Minister of Transport. Progress in transport included new agencies, such as air traffic and the development of the gyroscope. Road development should not be undertaken in a panic; he hoped there would be nothing like the frantic railway proposals of 1845.

Railway and Other Reports

Madras & Southern Mahratta Railway.—The directors have declared an interim dividend for the half year ended June 30, 1936, payable July 1, 1936, of £4 per cent., namely guaranteed interest £1 15s., and stockholders' revenue account £2 5s. This is a decrease of 10s. per cent., as compared with the interim dividend paid July 1, 1935.

British Oxygen Co. Ltd.—The directors recommend a final dividend for 1935 on the ordinary stock, including the free bonus shares recently issued, of 8 per cent., less tax. This makes a total dividend for the year of 15 per cent., plus a capital bonus of 28½ per cent. For the previous year a final dividend of 11 per cent. was declared, making 15 per cent., less tax.

Gulf, Mobile & Northern Railroad.—Railway operating revenues for the year 1935 amounted to \$6,173,210, an increase of \$942,253, or 18.01 per cent., over the previous year. Operating expenses were \$4,089,420, an increase of \$304,401, or 8.04 per cent., leaving a net operating revenue of \$2,083,790, which was \$637,852 higher than that for the previous year. Net operating income amounted to \$1,100,943, against \$512,547, and gross income rose from \$630,053 to \$1,211,959. A net income of \$404,710 was realised, comparing with a deficit of \$170,739 for 1934. Freight revenue increased by 18.59 per cent., and passenger revenue by 10.90 per cent.

Forthcoming Events

- May 1 (Fri.).—Past and Present Crew Pupils and Premiums, at Trocadero Restaurant, Piccadilly Circus, London, W.1. Annual Dinner.
- May 4 (Mon.).—Royal Society of Arts, John Street, London, W.C.2, 8 p.m. "Problems of Road Research (Lecture III)," by Mr. R. Stradling.
- May 5 (Tues.).—Institute of Transport (Metropolitan Graduate) at Inst. of Electrical Engineers, Savoy Place, W.C.2, 6 p.m. Annual General Meeting.
- Institution of Civil Engineers, Great George Street, London, S.W.1, 6 p.m. James Forrest Lecture.
- May 6 (Wed.).—Institute of Metals, at Inst. of Mechanical Engineers, Storey's Gate, London, S.W.1, 8 p.m. "The Escape of Electricity from Metals: Its Practical Consequences," by Mr. C. Paterson.
- Royal Society of Arts, John Street, London, W.C.2, 8 p.m. "The Oil Engine and its Influence on Road, Rail and Air Transport," by Mr. G. M. Junner.
- May 7 (Thurs.).—Institution of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. Annual General Meeting. Corporate Members and Associates only.
- Railway Club, at Royal Scottish Corporation Hall, Fetter Lane, London, E.C.4, 7.30 p.m. "Railway Accounts," by Mr. J. Quirey, C.B.E.
- Southern Railway (London) Lecture and Debating Society, at Chapter House, St. Thomas' Street, S.E.1, 5.45 p.m. Annual General Meeting.
- May 8 (Fri.).—Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, 7 p.m. Informal Meeting.
- Mansion House Association on Transport, at Trocadero Restaurant, Piccadilly Circus, London, W.1, 1.15 for 1.30 p.m. Annual Business Luncheon.

British and Irish Traffic Returns

| GREAT BRITAIN | Totals for 17th Week | | | Totals to Date | | |
|---------------------------------------|----------------------|-------------------|--------------|----------------|------------|--------------|
| | 1936 | 1935 [‡] | Inc. or Dec. | 1936 | 1935 | Inc. or Dec. |
| L.M.S.R. (6,917 mls.) | £ | £ | £ | £ | £ | £ |
| Passenger-train traffic... | 421,000 | 476,000 | - 55,000 | 6,834,000 | 6,753,000 | + 81,000 |
| Merchandise, &c. ... | 502,000 | 392,000 | + 110,000 | 7,883,000 | 7,548,000 | + 335,000 |
| Coal and coke ... | 256,000 | 155,000 | + 101,000 | 4,520,000 | 4,323,000 | + 197,000 |
| Goods-train traffic ... | 758,000 | 547,000 | + 211,000 | 12,403,000 | 11,871,000 | + 532,000 |
| Total receipts ... | 1,179,000 | 1,023,000 | + 156,000 | 19,237,000 | 18,624,000 | + 613,000 |
| L.N.E.R. (6,333 mls.) | 280,000 | 318,000 | - 38,000 | 4,509,000 | 4,483,000 | + 26,000 |
| Passenger-train traffic... | 340,000 | 294,000 | + 46,000 | 5,482,000 | 5,249,000 | + 233,000 |
| Merchandise, &c. ... | 239,000 | 181,000 | + 58,000 | 4,194,000 | 4,009,000 | + 185,000 |
| Coal and coke ... | 579,000 | 475,000 | + 104,000 | 9,676,000 | 9,258,000 | + 418,000 |
| Goods-train traffic ... | 859,000 | 793,000 | + 66,000 | 14,185,000 | 13,741,000 | + 444,000 |
| Total receipts ... | | | | | | |
| G.W.R. (3,746½ mls.) | 184,000 | 209,000 | - 25,000 | 2,861,000 | 2,842,000 | + 19,000 |
| Passenger-train traffic... | 193,000 | 145,000 | + 48,000 | 3,118,000 | 3,008,000 | + 110,000 |
| Merchandise, &c. ... | 109,000 | 62,000 | + 47,000 | 1,829,000 | 1,766,000 | + 63,000 |
| Coal and coke ... | 302,000 | 207,000 | + 95,000 | 4,947,000 | 4,774,000 | + 173,000 |
| Goods-train traffic ... | 486,000 | 416,000 | + 70,000 | 7,808,000 | 7,616,000 | + 192,000 |
| Total receipts ... | | | | | | |
| S.R. (2,154 mls.) | 260,000 | 293,000 | - 33,000 | 4,312,000 | 4,264,000 | + 48,000 |
| Passenger-train traffic... | 66,500 | 54,500 | + 12,000 | 995,000 | 1,005,000 | - 10,000 |
| Merchandise, &c. ... | 33,500 | 23,500 | + 10,000 | 605,000 | 557,000 | + 48,000 |
| Coal and coke ... | 100,000 | 78,000 | + 22,000 | 1,600,000 | 1,562,000 | + 38,000 |
| Goods-train traffic ... | 360,000 | 371,000 | - 11,000 | 5,912,000 | 5,826,000 | + 86,000 |
| Total receipts ... | | | | | | |
| Liverpool Overhead ... | 1,074 | 1,266 | - 192 | 18,968 | 18,696 | + 272 |
| (6½ mls.) | | | | | | |
| Mersey (4½ mls.) ... | 3,982 | 4,380 | - 398 | 70,315 | 69,506 | + 809 |
| *London Passenger Transport Board ... | 554,200 | 574,700 | - 20,500 | 23,355,600 | 22,947,900 | + 407,700 |
| IRELAND | | | | | | |
| Belfast & C.D. pass. | 1,941 | 3,750 | - 1,809 | 30,926 | 31,320 | - 394 |
| (80 mls.) | | | | | | |
| goods | 637 | 436 | + 201 | 8,950 | 8,189 | + 761 |
| total | 2,578 | 4,186 | - 1,608 | 39,876 | 39,509 | + 367 |
| †Great Northern pass. | 8,900 | 13,100 | - 4,200 | 133,650 | 129,550 | + 4,100 |
| (543 mls.) | | | | | | |
| goods | 10,650 | 7,900 | + 2,750 | 157,500 | 148,550 | + 8,950 |
| total | 19,550 | 21,000 | - 1,450 | 291,150 | 278,100 | + 13,050 |
| †Great Southern pass. | 32,995 | 42,968 | - 9,973 | 457,799 | 448,889 | + 8,910 |
| (2,076 mls.) | | | | | | |
| goods | 45,972 | 35,768 | + 10,204 | 670,786 | 635,955 | + 34,831 |
| total | 78,967 | 78,736 | + 231 | 1,128,585 | 1,084,844 | + 43,741 |

* 43rd week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes.
† 16th week.
‡ Including Easter week, 1935.

Institution of Civil Engineers Dinner

The annual dinner of the Institution of Civil Engineers was held on April 29, at the Savoy Hotel, with Mr. John D. Watson, President, in the chair. Lord Snell, Chairman of the London County Council, responding to the toast of "Local Government Authorities," proposed by Lord Macmillan, referred to the labours of Lord Macmillan during the last 8½ years in connection with the Income Tax Commission, the report of which had been followed up almost immediately by an increase of 3d. in that tax. Lord Snell also mentioned the growing influence of the machine, which must be used for man's benefit and not be allowed to become his master. Sir Kingsley Wood, Minister of Health, proposed the toast of "The Institution of Civil Engineers," and referred to the large sums spent annually by the Ministry of Health on engineering works. For the year 1935-36 the amount was no less than £22,000,000, having increased by £5,000,000 over the

previous year. Altogether in the last 15 years a total of £212,000,000 had been spent on municipal services with which the Ministry of Health's staff was concerned. Mr. John D. Watson, President, dealt in his reply with the success of the engineer in developing and using scientific knowledge and executive forces to control the sources of power in nature, adding that even famine and plague were now amenable to the engineer. Sir Clement Hindley, proposing the toast of "The Guests," welcomed specially Colonel Crompton, whom they regarded as the father of the engineering profession. Lord Rutherford replied.

TRAM AND BUS INTERAVAILABILITY EAST OF ALDGATE.—From Monday next, May 4, return ticket holders may make their return journey on either tram or bus from Aldgate or points eastward along Commercial Road.

British and Irish Railways
Stocks and Shares

| Stocks | Highest 1935 | Lowest 1935 | Prices | |
|-----------------------------------|-----------------|----------------|----------------------|--------------|
| | | | April 29, 1936 | Rise Fall |
| G.W.R. | | | | |
| Cons. Ord. ... | 55½ | 44½ | 48 | -½ |
| 5% Cons. Prefce. ... | 124 | 108 | 121½ | — |
| 5% Red. Pref. (1950) ... | 117 | 106½ | 109½ | — |
| 4% Deb. ... | 118½ | 108 | 115½ | +½ |
| 4½% Deb. ... | 122 | 110 | 118½ | — |
| 4½% Deb. ... | 129½ | 118 | 127½ | — |
| 5% Deb. ... | 140½ | 130 | 140½ | — |
| 2½% Deb. ... | 82½ | 68½ | 78 | — |
| 5% Rt. Charge ... | 137 | 128 | 135½ | +½ |
| 5% Cons. Guar. ... | 136½ | 120½ | 131½ | — |
| L.M.S.R. | | | | |
| Ord. ... | 25½ | 16 | 24 | — |
| 4% Prefce. (1923) ... | 58½ | 43½ | 72 | +½ |
| 4% Prefce. ... | 87½ | 73½ | 87½ | — |
| 5% Red. Pref. (1955) ... | 107 | 97½ | 107½ | — |
| 4% Deb. ... | 110½ | 99½ | 110½ | — |
| 5% Red. Deb. (1952) ... | 119½ | 111½ | 118½ | — |
| 4% Guar. ... | 105½ | 95½ | 105½ | — |
| L.N.E.R. | | | | |
| 5% Pref. Ord. ... | 157½ | 84 | 111½ | +14 |
| Def. Ord. ... | 79½ | 44 | 54 | +18 |
| 4% First Prefce. ... | 74½ | 48 | 69½ | +12 |
| 4% Second Prefce. ... | 31½ | 16½ | 27½ | +12 |
| 5% Red. Pref. (1955) ... | 92½ | 71 | 94½ | +1 |
| 4% First Guar. ... | 103½ | 93 | 103½ | +12 |
| 4% Second Guar. ... | 98½ | 82½ | 97½ | +1 |
| 3% Deb. ... | 86 | 75 | 84½ | +12 |
| 4% Deb. ... | 109½ | 98½ | 109 | +12 |
| 5% Red. Deb. (1947) ... | 118½ | 106½ | 112½ | — |
| 4½% Sinking Fund Red. Deb. ... | 112½ | 108 | 109½ | — |
| SOUTHERN | | | | |
| Pref. Ord. ... | 87½ | 69½ | 94 | -1 |
| Def. Ord. ... | 25½ | 16½ | 24 | — |
| 5% Prefce. ... | 124 | 108½ | 122½ | +1 |
| 5% Red. Pref. (1964) ... | 117½ | 109½ | 118½ | — |
| 5% Guar. Prefce. ... | 136½ | 121½ | 131½ | — |
| 5% Red. Guar. Pref. (1957) ... | 121½ | 112½ | 117½ | — |
| 4% Deb. ... | 116½ | 107 | 114 | +½ |
| 5% Deb. ... | 138 | 130½ | 138½ | — |
| 4% Red. Deb. ... | 115 | 106½ | 115½ | — |
| 1962-67 | | | | |
| BELFAST & C.D. | | | | |
| Ord. ... | 9 | 4 | 9 | — |
| FORTH BRIDGE | | | | |
| 4% Deb. ... | 111½ | 104½ | 105½ | — |
| 4% Guar. ... | 109½ | 104 | 105½ | — |
| G. NORTHERN (IRELAND) | | | | |
| Ord. ... | 20 | 7 | 19 | +2½ |
| G. SOUTHERN (IRELAND) | | | | |
| Ord. ... | 57½ | 14½ | 55 | — |
| Prefce. ... | 50 | 25½ | 60 | +½ |
| Guar. ... | 88½ | 51½ | 85½ | +1 |
| Deb. ... | 86½ | 70 | 89½ | — |
| L.P.T.B. | | | | |
| 4½% "A" ... | 130 | 119½ | 125½ | — |
| 5% "A" ... | 139½ | 130 | 135½ | — |
| 4½% "T.F.A." ... | 113½ | 108 | 110 | — |
| 5% "B" ... | 131½ | 122½ | 129 | +1 |
| "C" ... | 109½ | 91 | 104 | -1 |
| MERSEY | | | | |
| Ord. ... | 23½ | 9½ | 26½ | — |
| 4% Perp. Deb. ... | 100½ | 93½ | 97½ | — |
| 3% Perp. Deb. ... | 75½ | 67 | 76 | — |
| 3% Perp. Prefce. ... | 62 | 47½ | 64½ | — |

CONTRACTS AND TENDERS

The L.N.E.R. has placed contracts with H. Lees & Co. Ltd., Glasgow, for a 200-ton mechanical coaling plant for Carlisle, and a 200-ton electrically-operated coaling plant for Grantham.

L.N.E.R. Rail Orders

The L.N.E.R. has placed orders for steel rails as follow: Barrow Haematite Steel Co. Ltd., 1,000 tons; Cargo Fleet Iron Co. Ltd., 6,907 tons; Colvilles Limited, 5,000 tons; Consett Iron Co. Ltd., 7,250 tons; Dorman Long & Co. Ltd., 17,419 tons; S. Fox & Co. Ltd., 4,000 tons; Lancashire Steel Corporation Limited, 5,250 tons; Shelton Iron & Steel Co. Ltd., 2,000 tons; Skinninggrove Iron Co. Ltd., 5,674 tons; The Steel Company of Scotland, 4,500 tons; and United Steel Companies Limited, Workington Iron & Steel Branch, 1,000 tons.

The L.N.E.R. has also placed orders with Dorman Long & Co. Ltd. for 750 tons of steel conductor rails, and with the Barrow Haematite Steel Co. Ltd. for 1,000 tons chromium steel rails.

L.M.S.R. Order for New Vessel

William Denny & Bros. Ltd., Dumbarton, has received an order from the L.M.S.R. for a cargo and live-stock vessel for the Holyhead and Dublin (Northwall) service. The overall length of the vessel, which will be capable of carrying 720 head of cattle, will be 309 ft. Two electrically-operated cranes will be fitted for the rapid handling of cargo, and the machinery works will comprise two sets of Parsons single-reduction geared turbines. Steam generation will be by two coal-fired Babcock & Wilcox water-tube boilers.

The L.N.E.R. has placed contracts for printing machinery to be installed at Stratford works as follows:—

Linotype & Machinery Limited, No. 00 quad royal perfecter.

Cross Paper Feeder Co. Ltd., two Cross continuous feeders.

Caxton Machinery Co. Ltd., Dawson Payne double royal Wharfedale printing machine, and Auto Dux platen press.

E. A. Braddick Limited, rotary perforating machine, automatic wire stitching machine, and 60-in. advance self-clamp guillotine.

Aug. Brehmer's (British) Successors Limited, stripping and binding machine.

Waterlow & Sons Ltd., five ticket printing machines.

The L.N.E.R. has also placed contracts for creosote oil with Lane Brothers, Birmingham, for 400,000 gallons, and Scottish Tar Distillers Limited, Falkirk, for 30,000 gallons.

The Etablissements H. Mo'in of Paris have supplied to the P.O.-Midi Railways 3,200 flexometers and 110 levelling telescopes (*alidades*) for measured shovel packing, as described on page 736 of THE RAILWAY GAZETTE for April 17.

The General Electric Co. Ltd. has received a contract from the L.N.E.R. for 12 months' supplies of Osram and Robertson lamps.

E. Foster & Co., coal contractors, have placed orders for wagons with Charles Roberts & Co. Ltd. and the Gloucester Railway Carriage and Wagon Co. Ltd.

The Great Indian Peninsula Railway, it is reported, has placed an order, valued at £120,000, with the Henschel works at Kassel for 47 locomotive boilers.

Howrah Bridge Contract

The contract, valued at about £2,000,000, for the Howrah Bridge, has been awarded, it is announced by the British United Press, to the combine of Indian and British construction companies in India. The combine includes Messrs. Bunn, Braithwaite, and Jessop. Details of the contract and the tenders reported to have been considered were given on page 734 of THE RAILWAY GAZETTE for April 17.

The Bombay, Baroda & Central India Railway is prepared to receive tenders for wheels and axles for wagons. Application for tender forms should be made to the Secretary, the White

Mansion, 91, Petty France, S.W.1. (Closing date May 15.)

Railway Air Services Limited has ordered two four-engined DH 86A type, and six two-engined DH 89 type, aeroplanes from the De Havilland Aircraft Co. Ltd. Three of the DH 89's have already been delivered.

REICHSBAHN ROLLING STOCK STATISTICS.—A Reuters message states that at the end of 1935 locomotives on the German State Railway totalled 21,656, an increase of 987 on 1933 and of 551 on 1934, and railcars, at 1,561, showed an increase of 177 on 1934. Passenger coaches, on the other hand, showed a falling off of 987 to 60,341, and goods trucks of 25,810 to 596,598. At the end of 1934, however, the number of both passenger coaches and goods trucks had been still lower. Upkeep of rolling stock and special expenses cost the Reichsbahn RM. 535 million in 1935, an increase of RM. 22 million in 1934, and of RM. 113 million in 1933. Upkeep and improvements accounted for most of the 1935 figure, and the increase is attributed to the much greater volume of traffic arising from Government measures for fighting unemployment.

The Colonial Empire: Britain's Greatest Export Market

At a meeting of the Institute of Export held at 21, Tothill Street, S.W.1, on April 28, with Major Sydney Pascall, Vice-President, in the chair, Major W. E. Simnett, M.B.E., Assoc. Inst. C.E., Editor of *The Crown Colonist*, delivered an address on "The Colonial Empire—Britain's Greatest Export Market."

The Colonies, protectorates, and mandated territories, some forty in all, now collectively known as the Colonial Empire, covered two million square miles, or including the Anglo-Egyptian Sudan, three millions, that is to say, over thirty times the size of Great Britain and Northern Ireland; and the Colonial Empire had a population of sixty millions, or more than double that of all the Dominions put together. Before the depression, it had a total trade of £500,000,000 annually, and although some of its units might be small, collectively it formed a great area stretching across the globe, possessing immense resources, and still capable of considerable economic development.

The one great difference between the Colonies and the Dominions was that the Dominions had industries of their own, which were sometimes in competition with British industries, and their economic policies, in spite of the Ottawa Agreement, occasionally conflicted with that of the United Kingdom. The Colonies, on the other hand, possessed practically no manufactures of their own, but were broadly speaking primary producers of the fruits of the earth, minerals and raw materials, which they sold largely to us and to the Dominions and foreign countries.

They were ready to take in return British manufactured goods and equipment of every description. Theirs was, in fact, not a competitive but a complementary market, which was the best kind of market to have.

Describing the special features of the Colonial market and the means by which its requirements could be studied, Major Simnett quoted some significant figures. The total trade of the Colonial Empire (imports and exports) in the year 1934 amounted to £360,000,000. The 1935 figures were not yet completely available, but trade on the whole had been steadily improving since 1934, and prices also had shown in many instances an upward tendency, so that the total was certainly greater now. This compared with a total trade of £500,000,000 before the depression started, but the difference was accounted for by the fall in prices rather than any lessening in total volume; indeed it was quite possible that the volume was on the whole greater now than in 1929.

The Colonial Empire already took over 11 per cent. of our total exports; that is, it was our largest single market. India came next with about 9 per cent.; the United States, the leading foreign country, less than 5½ per cent. Looking at the *per capita* figures, New Zealand headed the list with purchases of £7 12s. per head, against the Colonies' 15s. 1d. per head, and India only 2s. 2d. But that 15s. 1d. per head could be vastly improved if we tackled the job properly.

In 1933, the Colonial Secretary stated that the proportion of our export trade going to the Colonies had increased by

OFFICIAL NOTICES

Rio Tinto Co. Ltd.

DIVIDEND ON SHARES TO BEARER.

HOLDERS OF SHARE WARRANTS TO BEARER are informed that they will receive PAYMENT of the DIVIDEND declared at the General Meeting held on the 24th inst., at the rate of Two Shillings and Sixpence per Share on the Preference Shares, less Income Tax, on and after Thursday, the 7th May, 1936, on presentation of Coupon No. 78, on the Preference Shares, either at the Company's Office in London, or at the Société Générale, 29, Boulevard Haussmann, Paris.

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24th April, 1936.

over 60 per cent. since 1924, in spite of the great fall in prices. But since Ottawa at least, the Colonies' exports to us had increased in much greater ratio than our exports to them. Therefore we were lagging behind our opportunity. According to the Statistical Abstract of the British Empire, in 1934, of the total exports of the Colonies, 26 per cent. came to the U.K.—of their total imports only about 22 per cent. were supplied by the U.K. That was not a position with which we should rest satisfied, even on the present basis of trade. Our task was to increase not only our share in Colonial markets, but also very considerably the total volume of Colonial trade.

Most native communities were pretty shrewd judges of quality, and would not buy shoddy stuff if they could get sound value at a reasonable price. Our effort should be to capture the quality market and leave the cheap lines to the Japanese and others. Very often cheap goods performed a useful service by familiarising the user with new things and perhaps improving his health and efficiency, thus both enabling and inducing him to purchase better goods in future. Standards of living would steadily rise as the economic position of native communities improved (therefore it was important we should help them to increase their own output and exports), and as that happened, they would increasingly demand better qualities and a greater variety of goods.

Systematic, continuous and intelligent advertisement was essential, coupled with knowledge of local requirements obtained both directly and through reliable agents, and readiness to adapt one's practice to local market needs and conditions. The lecturer recommended the study of the Colonial market as a whole, and this could conveniently be done through the columns of *The Crown Colonist*, which was the only journal in existence covering the Colonial Empire in its entirety. In process of time and natural development, the Colonial Empire, collectively already our largest oversea market, would, he believed, become of the greatest importance to the future of British industry.

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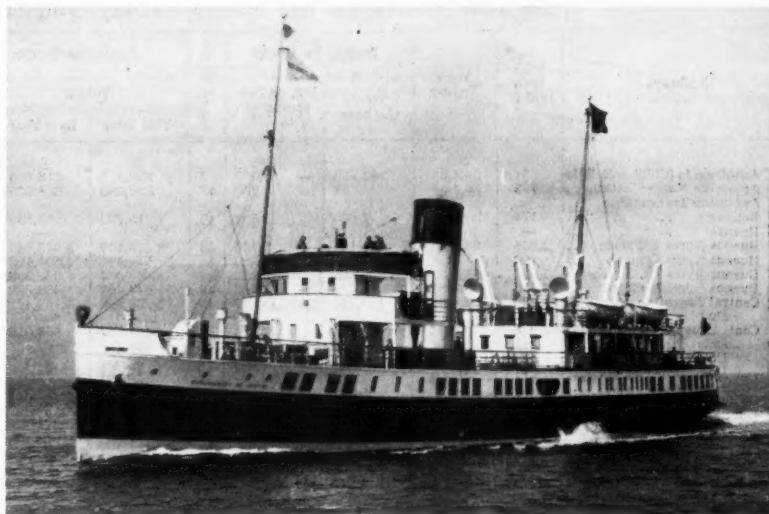
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New L.M.S. Turbine Steamer "Marchioness of Graham"



On Friday last, April 24, a large number of guests attended the inaugural cruise of the new turbine L.M.S.R. steamer *Marchioness of Graham*, which was built by the Fairfield Shipbuilding & Engineering Co. Ltd. of Govan, to replace the paddle steamer *Jupiter*, now sold for breaking up after forty years' service. The new vessel has a gross tonnage of 585.13 tons, an overall length of 230 ft. and a breadth of 30 ft. with accommodation for 1,332 passengers and crew. She has four decks, a boat deck, promenade deck, main deck, and lower deck. Geared turbines can propel her at 18 knots; her service speed will probably be between 16-17 knots. The *Marchioness of Graham* will be employed principally on the Arran and Ardrossan route.

The decoration and furnishing has been carried out in excellent taste, and full use is being made of modern square windows for lighting, instead of port-holes. The public rooms comprise a shelter or observation saloon for saloon passengers, dining saloon with alcoves, general lounge, tea room, and smoke

room. The third class dining room is at the forward end of the lower deck.

Since 1923, the L.M.S.R. has had seven steamers built for the Clyde Coast service, and at the present time a fast cargo steamer is under construction which will establish on July 1 a new early morning service to Arran for mails and newspapers. In addition, the company has on order a number of small craft.

At luncheon on board the vessel on Friday, Sir H. Arthur Rose, a Director of the L.M.S.R., pointed out in a short speech that the L.M.S.R. was not entirely a philanthropic institution, and he hoped its endeavours to give completely suitable facilities would be met by an increasing number of people travelling to Arran. "It was," Sir Arthur added, "a perfectly feasible thing for a person to dine and go to a theatre in London, leave Euston by the Night Scot, and have lunch in Arran on the following day." Since he had become a director of the company, he had tried to create in England an interest in the glorious Firth of Clyde as a holiday resort.

Railway Share Market

The stock and share markets have developed a rather subdued tone this week, due partly to the influence on sentiment of the weakness of Wall Street markets. Home railway stocks reflected the tendency rather to lower prices and were affected by the fear that over the next few weeks traffic receipts may make a less satisfactory comparison with the corresponding period of a year ago when passenger revenue benefited from the "jubilee" celebrations. Although the past week's figures compare with those for the Easter Monday week of 1935, they were favourable, a drop of £151,000 in passenger revenue having been offset by gains of £216,000 each in goods and coal.

L.M.S. stocks were active and although there was a fairly sharp reaction in the ordinary and 1923 preference earlier in

the week, a steadier tendency developed later on the further good traffic figures. The 4 per cent. preference was relatively steady. There were small recessions in L.N.E. preferred and deferred and the first and second preference reacted more than half a point. Great Western showed an improved tendency following news of last week's £70,000 traffic increase. Southern preferred and deferred remained out of favour, although it is realised that the decrease in traffics has to be accounted for by the fact that comparison is with a period last year when there was an exceptional stimulus to passenger receipts. Similar remarks apply to the London Transport figures; the "C" stock also receded this week. Guaranteed stocks and debentures were very steady and have been well maintained.

Foreign railway stocks were again in-

active and rather featureless. Among Argentine stocks B.A. Great Southern remained out of favour and is 16½, against 17½ a week ago, while the 5 per cent. preference is 65, against 65½. B.A. Western, B.A. Pacific and Central Argentine have lost from ½ to ¼ on balance. Cordoba Central debentures continued their downward movement. They are now 36, compared with 44 a week ago. With this exception debenture stocks were well maintained, but preference stocks were a point or more lower in most cases. San Paulo continued the improved tendency which followed the announcement of the dividend and on balance they have moved up from 55 to 56½. American railroad stocks have declined rather heavily as a result of the weakness of Wall Street markets. Union Pacific, which was 126 a week ago, is now 119 and New York Central 34, against 39½. Canadian Pacific ordinary and preference were moderately lower.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

| Railways | Miles open 1935-36 | Week Ending | Traffics for Week | | No. of Weeks | Aggregate Traffics to Date | | | Shares or Stock | Prices | | | | | |
|-------------------------------|-----------------------|----------------|--------------------|---------------------------------------|--------------|----------------------------|--------------|-------------------------|-----------------------|-----------------|----------------|------------------|--------------------------|------|-----|
| | | | Total this year | Inc. or Dec. compared with 1935 | | Totals | | Increase or Decrease | | Highest 1935 | Lowest 1935 | Apr. 29, 1936 | Yield % (See Note) | | |
| | | | | | | This Year | Last Year | | | | | | | | |
| South & Central America. | | | | | | | | | | | | | | | |
| Antofagasta (Chili) & Bolivia | 834 | 26.4.36 | 13,720 | — | 17 | 229,310 | 212,600 | + | 16,710 | Ord. Stk. | 23 | 141½ | 22 | NH | |
| Argentine North Eastern .. | 753 | 25.4.36 | 8,684 | — | 43 | 336,258 | 314,239 | + | 22,019 | A. Deb. | 7 | 4 | 41½ | NH | |
| Argentine Transandine .. | — | — | — | — | — | — | — | — | — | 6 p.c. Deb. | 13 | 30 | 47½ | 57½ | |
| Bolivar | 174 | Mar., 1936 | 7,600 | + | 500 | 13 | 19,750 | 19,550 | + | 200 | Ord. Stk. | 14 | 11 | 14 | 39½ |
| Brazil | — | — | — | — | — | — | — | — | — | Ord. Stk. | 101½ | 47½ | 8 | NH | |
| Buenos Ayres & Pacific .. | 2,806 | 25.4.36 | 101,469 | + | 1,706 | 43 | 3,616,197 | 3,343,840 | + | 272,357 | Mt. Deb. | 21 | 10 | 17½ | NH |
| Buenos Ayres Central .. | 190 | 11.4.36 | 882,000 | — | \$18,800 | 41 | \$4,519,400 | \$4,524,100 | — | \$13,700 | Ord. Stk. | 27 | 13½ | 17 | NH |
| Buenos Ayres Gt. Southern .. | 5,084 | 25.4.36 | 119,683 | — | 35,432 | 43 | 5,645,044 | 6,243,003 | — | 597,959 | " | 24 | 10 | 13 | NH |
| Buenos Ayres Western .. | 1,930 | 25.4.36 | 56,698 | — | 1,256 | 43 | 1,944,151 | 1,933,880 | + | 10,271 | " | 177 | 7 | 10 | NH |
| Central Argentine | 3,700 | 25.4.36 | 105,620 | — | 35,897 | 43 | 5,136,982 | 5,158,497 | — | 21,515 | Dfd. | 9 | 3¼ | 61½ | NH |
| Do. | — | — | — | — | — | — | — | — | — | Ord. Stk. | 81½ | 3 | 6 | NH | |
| Cent. Uruguay of M. Video .. | 273 | 18.4.36 | 12,791 | + | 3,040 | 42 | 462,567 | 583,012 | — | 120,445 | — | — | — | — | — |
| Do. Eastern Extn. .. | 311 | 18.4.36 | 2,297 | + | 645 | 42 | 84,656 | 80,189 | + | 4,467 | — | — | — | — | — |
| Do. Northern Extn. .. | 185 | 18.4.36 | 1,728 | + | 296 | 42 | 59,607 | 45,310 | + | 14,297 | — | — | — | — | — |
| Do. Western Extn. | 211 | 18.4.36 | 868 | + | 290 | 42 | 36,954 | 32,677 | + | 4,277 | — | — | — | — | — |
| Cordoba Central | 1,218 | 25.4.36 | 26,380 | + | 1,310 | 43 | 1,199,850 | 1,206,440 | — | 6,590 | Ord. Inc. | 4 | 1 | 2 | NH |
| Costa Rica | 188 | Feb., 1936 | 14,640 | — | 562 | 35 | 106,919 | 131,069 | — | 24,150 | Stk. | 35 | 30 | 36 | 59½ |
| Dorada | 70 | Mar., 1936 | 12,900 | + | 1,090 | 13 | 38,590 | 33,400 | + | 5,190 | 1 Mt. Db. | 103½ | 102½ | 104½ | 5½ |
| Entre Rios | 810 | 25.4.36 | 9,689 | — | 742 | 43 | 462,025 | 526,529 | — | 64,504 | Ord. Stk. | 15 | 6 ½ | 9 | NH |
| Great Western of Brazil .. | 1,082 | 25.4.36 | 6,600 | + | 1,100 | 17 | 153,400 | 161,900 | — | 8,500 | Ord. Sh. | 12 | 5½ | 12 | NH |
| International of Cl. Amer. | 794 | Feb., 1936 | \$491,759 | + | \$82,680 | 9 | \$993,298 | \$838,555 | + | \$154,743 | — | — | — | — | — |
| Interoceanic of Mexico .. | — | — | — | — | — | — | — | — | — | 1st Pref. Stk. | 12 | 32 | 12 | NH | |
| La Guaira & Caracas .. | 22½ | Mar., 1936 | 4,310 | + | 270 | 13 | 12,960 | 10,540 | + | 2,420 | Ord. Stk. | 81½ | 8 | 81½ | NH |
| Leopoldina | 1,918 | 25.4.36 | 12,477 | — | 107 | 17 | 298,931 | 287,653 | + | 11,278 | Ord. Stk. | 81½ | 21½ | 7 | NH |
| Mexican | 483 | 21.4.36 | \$248,700 | — | \$66,900 | 16 | \$4,086,700 | \$3,875,600 | + | \$211,100 | — | 11½ | 14 | 34 | NH |
| Midland of Uruguay .. | 319 | Mar., 1936 | 7,747 | + | 1,449 | 39 | 64,059 | 91,386 | — | 27,327 | — | 11½ | 11 | 11 | NH |
| Nitrate | 401 | 15.4.36 | 4,143 | — | 2,661 | 15 | 48,608 | 41,922 | + | 6,686 | Ord. Sh. | 64½ | 42½ | 27½ | NH |
| Paraguay Central | 274 | 18.4.36 | \$2,733,000 | + | \$1,394,000 | 42 | \$89,658,000 | \$46,159,000 | + | \$43,499,000 | Pr. Li. Stk. | 801½ | 60 | 77 | 71½ |
| Peruvian Corporation .. | 1,059 | Mar., 1936 | 87,170 | + | 29,660 | 39 | 703,226 | 557,156 | + | 146,070 | Pref. | 108½ | 67½ | 12½ | NH |
| Salvador | 100 | 18.4.36 | 222,900 | — | 1,650 | 42 | 682,246 | 681,452 | — | 85,206 | Pr. Li. Db. | 65 | 61 | 65 | 47½ |
| San Paulo | 153½ | 19.4.36 | 27,200 | + | 10,139 | 16 | 454,875 | 349,591 | + | 105,284 | Ord. Stk. | 80 | 35 | 56½ | 71½ |
| Tatal | 164 | Mar., 1936 | 4,265 | + | 87 | 39 | 32,750 | 26,885 | + | 5,865 | Ord. Sh. | 111½ | 11 | 1 | 10 |
| United of Havana | 1,353 | 25.4.36 | 32,542 | + | 11,277 | 43 | 1,004,548 | 1,006,466 | — | 1,918 | Ord. Stk. | 31½ | 1 | 3 | NH |
| Uruguay Northern | 73 | Mar., 1936 | 921 | + | 93 | 39 | 7,288 | 9,835 | — | 2,547 | Deb. Stk. | 41½ | 21½ | 41½ | NH |
| Canada. | | | | | | | | | | | | | | | |
| Canadian National | 23,648 | 21.4.36 | 719,012 | + | 95,618 | 16 | 10,087,503 | 9,560,345 | + | 527,158 | Perp. Dbs. | 78½ | 52½ | 67½ | 51½ |
| Canadian Northern | — | — | — | — | — | — | — | — | — | 4 p.c. Gar. | 103½ | 93 | 101½ | 31½ | |
| Grand Trunk | — | — | — | — | — | — | — | — | — | Ord. Stk. | 141½ | 8½ | 11½ | NH | |
| Canadian Pacific | 17,244 | 21.4.36 | 471,000 | + | 5,600 | 16 | 7,325,600 | 6,665,400 | + | 660,200 | — | — | — | — | — |
| India. | | | | | | | | | | | | | | | |
| Assam Bengal | 1,329 | 31.3.36 | 39,390 | + | 4,827 | 52 | 1,268,989 | 1,419,915 | — | 150,926 | Ord. Stk. | 92½ | 77½ | 85½ | 3½ |
| Barsi Light | 202 | 31.3.36 | 5,580 | + | 2,648 | 52 | 143,572 | 135,772 | + | 7,800 | Ord. Sh. | 105 | 77½ | 72½ | 6½ |
| Bengal & North Western .. | 2,112 | 10.4.36 | 80,207 | + | 80,207 | 52 | 80,207 | 77,322 | + | 2,885 | Ord. Stk. | 301½ | 291 | 307½ | 5½ |
| Bengal Dooars & Extension .. | 161 | 31.3.36 | 3,207 | — | 178 | 52 | 138,395 | 154,275 | — | 15,880 | — | 127½ | 122 | 125½ | 59½ |
| Bengal-Nagpur | 3,268 | 20.3.36 | 178,800 | — | 6,070 | 51 | 6,254,622 | 5,844,638 | + | 409,984 | — | 105 | 100½ | 102½ | 3½ |
| Bombay, Baroda & Cl. India .. | 3,072 | 20.4.36 | 281,850 | + | 38,100 | 3 | 562,425 | 476,625 | + | 85,800 | — | 115½ | 110 | 112½ | 75½ |
| Madras & Southern Mahratta .. | 3,230 | 10.4.36 | 159,750 | + | 11,193 | 1 | 159,750 | 148,557 | + | 11,193 | — | 128½ | 113½ | 115½ | 7½ |
| Rohilkund & Kumaon | 572 | 10.4.36 | 19,009 | + | 241 | 1 | 19,009 | 18,768 | — | 241 | — | 294 | 262 | 299½ | 56½ |
| South India | 2,531 | 31.3.36 | 111,595 | — | 7,664 | 52 | 3,920,145 | 4,135,221 | — | 215,076 | — | 119½ | 104½ | 106½ | 7½ |
| Various. | | | | | | | | | | | | | | | |
| Beira-Umtali | 204 | Feb., 1936 | 61,814 | + | 2,183 | 21 | 316,206 | 305,135 | + | 11,071 | — | — | — | — | — |
| Bilbao River & Cantabrian .. | 15 | Mar., 1936 | 1,207 | — | 610 | 13 | 4,677 | 6,128 | — | 1,451 | — | — | — | — | — |
| Egyptian Delta | 622 | 10.4.36 | 5,907 | + | 351 | 1 | 5,907 | 5,556 | — | 351 | Pr. Sh. | 2 | 16 | 15 | 51½ |
| Great Southern of Spain .. | 104 | 18.4.36 | 816 | — | 1,100 | 16 | 17,747 | 30,474 | — | 12,727 | Inc. Deb. | 3½ | 2 | 3½ | NH |
| Kenya & Uganda | 1,625 | Feb., 1936 | 245,527 | + | 26,405 | 9 | 478,026 | 459,598 | + | 18,428 | B. Deb. | 48 | 36 | 46½ | 7½ |
| Manila | — | — | — | — | — | — | — | — | — | 1 Mg. Db. | 104½ | 100 | 103½ | 4½ | NH |
| Mashonaland | 913 | Feb., 1936 | 98,894 | — | 6,317 | 21 | 509,798 | 569,259 | — | 59,461 | Inc. Deb. | 98½ | 93 | 94½ | 56½ |
| Midland of W. Australia .. | 277 | Feb., 1936 | 13,498 | + | 2,402 | 35 | 111,949 | 110,221 | + | 1,728 | 4 p.c. Db. | 105½ | 101 | 105 | 31½ |
| Nigerian | 1,905 | 14.3.36 | 36,617 | + | 4,214 | 50 | 1,844,545 | 1,921,060 | — | 76,515 | — | — | — | — | — |
| Rhodesia | 1,538 | Feb., 1936 | 179,001 | — | 769 | 21 | 935,446 | 932,189 | — | 3,257 | — | — | — | — | — |
| South African | 13,250 | 4.4.36 | 634,304 | + | 88,748 | 1 | 634,304 | 545,556 | + | 88,748 | — | — | — | — | — |
| Victoria | 4,728 | Dec., 1935 | 866,995 | — | 3,320 | 26 | 4,826,292 | 4,751,974 | + | 74,318 | — | — | — | — | — |
| Zafra & Huelva | 112 | Feb., 1936 | 10,741 | + | 219 | 9 | 21,230 | 21,904 | — | 674 | — | — | — | — | — |

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/8

† Receipts are calculated @ 1s. 6d. to the rupee. ‡ Ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value.

Electric Railway Traction

Danish Extension

WITH the inauguration of the summer timetables on May 15, yet another section of the Copenhagen suburban lines will be transferred to electric traction. This is the 7-mile line from Hellerup to Holte, and its conversion marks the completion of the electrification of the Danish State Railways suburban lines in the north of Copenhagen. A ten-minute service is to be provided in rush hours and a twenty-minute service during the day, and train operation will be facilitated by the installation of colour light signals.

The Best System of Electrification

ELECTRIFICATION schemes are occasionally turned down, and more often a wrong idea gained of the advantages of electrification, by considering only one system of conversion. In Britain the word "electrification" is almost synonymous with "direct current," and a tension of 1,500 volts has been more or less standardised for main line work. Other countries have standardised various higher tension d.c. or single phase systems, for the advantages of one type are obvious. The disadvantage is not so obvious, but lies in the fact that for any given set of conditions (the principal items of which are the amount of traffic and the rate of interest) there is a best system, and one which may pay a good return on capital while other systems would show no saving. The difference in the first cost of the various principles of railway electrification is not so great as it was at one time; nevertheless it is sufficient to turn the scale in certain instances. Such a case arose a short time ago during the proposals to electrify a section of main line in Rumania. Very thorough estimates were made for a 3,000-volt d.c. conversion, and they showed that electrification would not be a paying proposition. Attention was turned later to a certain type of single-phase conversion, and, to the surprise of the estimators (who were d.c. men with little experience in single-phase traction), it was found that quite a good case could be made for electrification.

As it stands today, the art of electrification necessitates one or other item of the equipment being complicated and expensive, and it depends very largely upon traffic conditions, both present and what is expected in the future, which that item should be. Direct current schemes have relatively simple locomotives, but relatively numerous and costly substations and transforming stations; low-periodicity single-phase traction has few substations, light overhead construction, and the locomotives are not necessarily very complicated; but special power stations must be built, or expensive converting apparatus installed if the high frequency industrial supply is to be tapped. The Kando single-phase system has complicated and expensive locomotives, but the substations are few and extremely simple, and the industrial supply is used directly; the three-phase system has the simplest locomotives but the overhead system is costly to construct and maintain (this type of electrification is to be found now only in Italy).

The Hungarian State Railways make an economical and operating success of the 50-cycle Kando system because, for electrification, the traffic is light, and therefore the most expensive portion of the equipment, the locomotives, are few in number. Similar conditions showed that the Kando system would give favourable results on the Rumanian State Railways. If a dense traffic is to be carried over a given section of line the locomotives will be numerous and their cost will form a greater proportion of the total outlay. They should therefore be kept as simple as possible, and this postulates direct current. If the eventual railway load is to be very large, it may pay to use special low-periodicity generating apparatus, especially when railway electrification has come before general industrial electrification. The extra expense in such cases may be limited to that for the actual generating machinery in either hydro or steam plants, for it is not impossible for both high and low frequency supplies to be obtained from the same station. Generally it is taken that power obtained from hydro-electric stations is very cheap, but actual financial results (because of the high proportion of capital charges to running cost) do not always show this to be so, and usually there is but a very small amount in favour of water power.

Electric Traction on Heavy Grades

IN a paper read before the Manchester and District Traffic Association on April 16, Mr. R. Brooks, the Chief Traction Engineer of Metrovick, drew attention to the capacity of the electric locomotive for high speed up grades and the high possible ratio of the average to the maximum speeds. Both of these features are due to the overload capacity of electric vehicles through the almost unlimited power which can be obtained from the power station feeding the line. For this reason, and also because of the smoke nuisance, which is at its worst when steam locomotives are operating trains over heavy grades having numerous tunnels, mountain railways form a considerable proportion of the world's electrified line. But the critical point may be reached with even a moderate inclination, such as the 1 in 100 of the Sheffield-Manchester line on the L.N.E.R., where, according to Mr. R. Bell, the Assistant General Manager, electrification will reduce the end to end time of a 1,000-ton mineral train by 80 min. and also reduce the headway in Woodhead tunnel from 15 min. to 5-7½ min. Not infrequently electrification has obviated the doubling of a heavily graded line, a proceeding which would have been much more costly than conversion and even then would not have given the all-round improvement in traffic operation which was found possible with electric traction. What is actually the steepest adhesion grade worked by electric vehicles is difficult to say, but we imagine that it is the 10-mile grade of 1 in 11 on the 1,500-volt d.c. system of the Guatemala railways which forms part of the 27-mile route from San Felipe, 1,000 ft. above sea level, to Quezaltenango, 9,000 ft. above the sea.

MAIN-LINE ELECTRIFICATION THROUGHOUT THE WORLD

By E. R. KAAH, *Elektrisierungsdirektor of the Austrian Federal Railways**

AMONG the measures adopted by railways to improve their economic situation, the introduction of electric traction in many railways in almost all civilised countries holds a unique position. The first reasons for electrification are what may be called internal considerations of the railway companies, and the second considerations concerning the requirements of the countries as a whole. It is possible, however, that both reasons may be co-existent.

To the first class belong considerations of an economic character regarding the technical requirements of the service. Among these are the necessity for reducing the costs of the service; increasing the capacity of the system; raising the speed of all types of trains; reducing the costs of passenger transport; subdividing and increasing the service by means of appropriate electric railcars; obviating the necessity of doubling the tracks (which work would have to be carried out if steam traction were retained) or extending stations, especially termini; improving the suburban service of large towns, which could not be done with steam traction if the traffic became any heavier; shortening the new lines, since electric traction permits the construction of steeper gradients; and the like.



Amsteg hydro-electric power station of the Swiss Federal Railways. This view shows also the viaduct carrying the St. Gotthard line over the ravine

To the second class belong the following:—Railway electrification finds employment for many, especially for skilled labour. It enables a country which lacks coal to be independent of foreign coal, which improves the commercial balance; the regularity of the traffic is not liable to suffer from stoppages of coal imports from abroad in consequence of strikes, political disturbances, or even wars in or with other countries. In addition, any water-power stations in a country may be more efficiently utilised; tourist traffic is improved; and mobilisation in case of war is facilitated.

Electric traction on main lines employs two systems mainly. The first is the single-phase alternating-current system, generally of 16½ cycles and a voltage at the

THE WORLD'S RAILWAY ELECTRIFICATION. MAIN LINES ONLY

| Continent | Track Kilometrage Electrified | | | | |
|----------------|-------------------------------|---------------|--------------|----------|-------------|
| | Direct Current | | Single-Phase | | Three-Phase |
| | 1,200-1,500 V | 2,400-3,000 V | 11,000 V | 15,000 V | 3,700 V |
| Europe .. | 3,500 | 1,600 | — | 7,800 | 2,140 |
| America .. | 650 | 2,180 | 1,430 | 150 | — |
| Asia .. | 950 | — | — | — | — |
| Africa .. | — | 900 | — | — | — |
| Australasia .. | 170 | — | — | — | — |
| | 5,270 | 4,880 | 1,430 | 7,950 | 2,140 |
| | 10,150 | | 9,380 | | |

contact line of 15 kV. The other is the direct-current system, generally at a voltage of 3,000 or 1,500 at the overhead equipment. In addition the three-phase system of 3,600 volts at the overhead equipment is used in a few cases, and lately also a system has been introduced with single-phase alternating current at the overhead equipment, which is obtained from a three-phase 50-cycle supply by conversion on locomotives or in substations, in both cases by means of grid-controlled mercury-arc rectifiers.

Switzerland

Switzerland has progressed further with electric traction than any other European country. Apart from the Federal Railways, there are in Switzerland a number of private companies which carry a large amount of traffic. Without exception, these employ electric traction.

The Swiss Federal Railways started with an extensive programme of electrification, which was completed by the end of 1928 and comprised 1,040 route miles, so that 57·8 per cent. of all the system was electrified, but 85 per cent. of the traffic (in gross ton-miles) was operated by electricity. The satisfactory experience gained with electric traction caused the Swiss Federal Railways in 1929 to continue the electrification, which includes a further 315 route-miles. By the middle of 1936, 75 per cent. of the system will be electrified, corresponding to about 92·5 per cent. of the gross ton-miles to be hauled. The Swiss Federal Railways operate their lines with single-phase alternating current at 15 kV. and 16½ cycles. They considered it expedient to obtain the greater part

* Abstract of a paper read before the Institution of Electrical Engineers, April 30, 1936.

of their energy for the electrified system from the seven water-power stations owned by the railway. Altogether, 491 electric locomotives are used for haulage on lines of widely differing types of construction, 21 locomotives for shunting, and 48 electric railcars. The energy used amounts to 520,000,000 kWh. a year, 80 per cent. of which is generated in railway-owned power stations.

Germany

The original reason for electrification on the German State Railway was the rationalisation of the service. In recent years, however, considerations of national and political economy became the deciding factors; these are mainly the occupation of the highly developed German industry and the relief of unemployment.

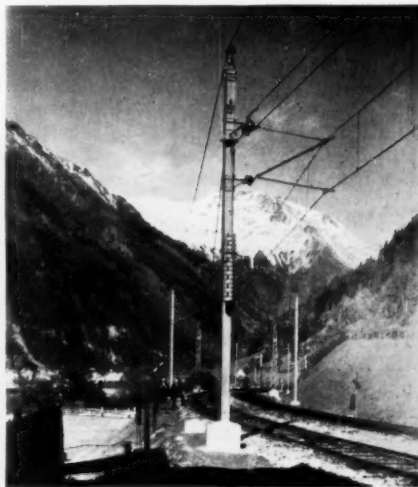
In southern Germany, in the countries of Bavaria, Württemberg, and Baden, the energy is obtained from water-power stations, which in most cases do not belong

Berlin lines which use d.c., and the Hamburg metropolitan, which is operated with single-phase at 6 kV. 25 cycles.

Two more exceptions are the lines in the Black Forest, the Höllentalbahn and the Dreiseenbahn, which branches off near the health-resort of Titisee. The power for these lines is obtained from the general supply system (50 cycles) of the country by means of Scott-connected transformers. The alternating current at the overhead equipment is supplied to the traction motors by means of grid-controlled mercury-arc rectifiers. This will provide useful information as to the use of such rectifiers for railway operation.

Sweden

The following figures give a survey of the importance of electric traffic on the Swedish State Railways. In July, 1935, 1,380 miles were electrified; a short time ago another 142 miles were added, so that 1,522 miles have been worked electrically since the end of last year. By



Two views of the 15 kV. single-phase lines of the Austrian Federal Railways

to the Reichsbahn but are mainly state-owned. The second district is in central Germany between Leipzig, Halle, and Magdeburg, and obtains its power from brown-coal power stations. The third is in Silesia. In this district the energy is principally obtained from a steam power station, which consumes coal raised on the spot; this, however, is of low calorific value and cannot easily be used for any other purpose. The fourth district is situated in and around Berlin, and comprises the Berlin Stadt, Ring, and Vorortbahnen. The power needed for this system is obtained from privately-owned steam stations. The fifth district comprises the metropolitan and suburban lines of Hamburg. These obtain their supply partly from a railway-owned power station and partly from a privately-owned station. Among the lines that have recently been electrified the Munich-Augsburg-Stuttgart and Augsburg-Nuremberg lines are of the greatest importance. The electrification of the last-named line is to be extended via Halle and via Leipzig as far as Berlin. Thus an electric connection between Munich and Berlin will be established and a connection from north to south from Berlin via Munich, Innsbruck, Rome, and Naples, to the southernmost points of Italy, will be completed.

The single-phase system, with 15 kV. at the overhead equipment and at 16 $\frac{2}{3}$ cycles, was selected for the entire system of the Reichsbahn, with the exception of the

June, 1937, the mileage will amount to 2,600, and the electrification of a further 680 miles is being proposed. The fact that 30 track miles a month are being converted is characteristic of the speed with which the work is carried out. The work already done or scheduled for electrification comprises 40 per cent. of the entire length of the Swedish State Railways, but these lines carry more than 80 per cent. of the coach axle-miles. After the work proposed to the government by the State Railway administration has been carried out, these percentages will rise to 60 and 95 respectively.

The Swedish State Railways are supplied with power obtained from water-power stations scattered all over the country. These are chiefly the property of the State, only a very small proportion being privately owned. It is of interest to note that the Swedish State Railways have lately adopted the so-called movable converter stations, the transformers being installed in one car, while the converter is installed in a second. This system has certain advantages, but is not without drawbacks. Certain conditions, however, peculiar to the Swedish State Railways, are responsible for this arrangement.

Norway

In this country 137 of the 2,200 miles of the State Railways are electrified. With the exception of the Ofotenbahn, 26 miles in length, which continues the

Swedish Riksgränsenbahn on Norwegian territory as far as Narvik, all the lines are in the southern part of the country. Part of the energy is generated in the Hakavik power station, and part is converted from a three-phase supply. Electrification on the lines, which in some places have gradients of 1 in 38, was so satisfactory that, as the result of a decision of the Storting, electric traction will be introduced on a further 75 miles of the system.

Austria

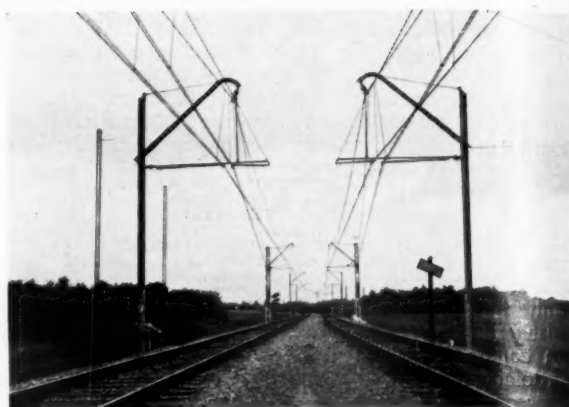
Even before 1914 the question of railway electrification had been studied in Austria. But owing to the fact that the Austria of those times had extensive hard-coal fields at her disposal, the matter was not considered urgent. Only two standard-gauge lines were electrified; these were the Mittenwaldbahn in the Tyrol, in 1912, and the Vienna-Bratislava line, in 1914.

In 1918 the situation in Austria became difficult owing to the dependence on the import of foreign coal for the railway service. She was therefore driven to exploit the natural resources at her disposal and to introduce electric traction, taking the supply from hydro-electric stations. In 1920, the Austrian parliament decided on an extensive scheme of electrification, which, amended by a further bill in 1925, provided for the electrification of all the lines of Federal Railways west of Salzburg to the Swiss frontier, and also the line from Stainach-Irdning to Attnang-Puchheim. Electric traction had been introduced on about 136 miles of the Austrian railways before the war, and it was extended a further 439 miles after the war, so that 575 miles, or 16 per cent. of the total, are now electrified. These lines carry 22 per cent. of the entire traffic of the Federal Railways.

The system chosen is the single-phase alternating current at 15 kV. 16 $\frac{2}{3}$ cycles at the contact wire. The supply is obtained mainly from four railway-owned water-power stations. About 306 miles of transmission lines at 55 kV. and about 770 miles of contact wires were constructed. 178 locomotives and 12 electric motor-coaches are in service. Four large locomotive sheds were built, in addi-



The passing place in the Apennine tunnel on the 3,000-volt d.c. Direttissima between Bologna and Florence



Overhead construction on the 1,500-volt d.c. lines of the Danish State Railways near Copenhagen

tion to a locomotive repair shop attached to a central repair shop. The whole enterprise formed the largest single item of constructive work carried out in Austria in post-war times; the cost amounted to more than £13,000,000.

It is the intention of the Austrian Federal Railways to continue the electrification with a view to providing work for the highly developed industry of the country. A great programme has been devised, comprising the Salzburg-Vienna line, the southern railway as far as Graz, the eastern railway to the Hungarian frontier, and some other lines of less importance. Also the introduction of electric traction on the suburban lines of Vienna is under consideration. A necessary condition for the realisation of the programme is the raising of funds by means of a loan on easy terms. To commence with, it is proposed to electrify the line Salzburg-Vienna, 191 miles in length.

Hungary

The Kandó system of electrification differs fundamentally from all other systems, and has hitherto been used exclusively by the Hungarian State Railways on the Budapest-Hegyeshalom route and on the Budapest-Alag trial line. The Kandó scheme is based on the idea of using three-phase current, which is the general supply system of the country, without conversion, though it uses single-phase current of the same frequency as the three-phase system, i.e., 50 cycles. In Bánhida was erected a large power station for general supply, burning inferior, earthy coal raised in the vicinity and not worth transporting. In this power station three sets of turbo-generators of 30,000 h.p. each were installed. The voltage generated is stepped up to 110 kV. and conducted by means of a transmission line consisting of two systems with three cables each to the four substations of the railway. Each substation has two single-phase transformers with a continuous rating of 4,000 kVA., which can be increased to 8,000 kVA. These transformers step down the voltage to 16 kV., which is fed to the overhead equipment.

Italy

Approximately 870 miles of the private railways, which comprise a total of about 3,100 miles, are electrically operated. On the State Railways two systems of supply are in use. With the exception of a few earlier test-lines the three-phase system at 3,600 to 3,700 volts and 16 $\frac{2}{3}$ cycles is used in northern Italy, while d.c. at 3,000 volts is used in central and southern Italy. The extent of the present electric operation may be gathered from the following figures: 1,330 miles of line are operated with the three-

phase system, and 767 miles with the d.c. system, a total of 2,097 miles. The electrification of 1,640 miles of double track and 1,076 miles of single track lines, 2,716 miles in all, has been decided upon.

The greater part of the energy is obtained from water-power stations, two-thirds of which are railway-owned and one-third privately owned. The transformation and conversion, respectively, of the energy supplied by transmission lines at 60 to 150 kV. are carried out by transformer stations for the three-phase system, and for the d.c. lines in substations by means of mercury-arc rectifiers.

Poland

In Poland the first electrification was introduced in 1927 on a suburban line of Warsaw, 20 miles in length. At present 60 miles of suburban lines are being electrified. The work is being carried out by English firms with English capital. Direct current at 3,000 volts was selected; and this is converted from three-phase current obtained from a private company in Warsaw. The intention is to use electricity for passenger trains, while goods trains will be steam-driven. It has been calculated that an annual saving of 20 per cent. will result. On expert advice electric



Barendrecht station on the 1,500-volt d.c. lines of the Netherlands Railways

traction was also proposed for several main lines. From an economic point of view the electrification of a total of 1,120 miles is justified.

Rumania

The electrification of the Campina-Kronstadt section of the State Railways was proposed some time ago, the main reason being that the capacity of this single-track mountain-line would be increased. As the electrification would enable the construction of a double track to be postponed for some time, it would be justified from the economic point of view. The scheme has been shelved for the time being owing to a great reduction in traffic, but it will come to the fore again as soon as economic conditions improve.

Czechoslovakia

Electric traction was introduced in 1928 solely for the stations and tunnel tracks of Prague, comprising 50 miles of track. Direct current at 1,500 volts was used, being converted from the municipal three-phase system of Prague. When this electrification was projected it was considered that electric traction would be generally introduced. Great power stations near the coalfields, burning waste coal, were to supply the necessary power. There seems to be no likelihood, however, that this scheme will be realised in the near future.

U.S.S.R.

In this country the mileage of electrified lines was about 300 at the commencement of 1935. On about 600 miles of track the necessary constructional work is being carried out. As far as the author is aware, an aggregate of 3,180 miles of track is to be electrified by the end of 1937, 2,240 miles of which are main lines, mostly in the south. On the Batum-Tiflis line, the section Zestafoni-Chasburi, 40 miles in length and with gradients up to 1 in 34, has been in operation since 1933. The suburban lines to be electrified by 1937 will cover a mileage of 350.

Denmark

The scheme for the electrification of the suburban lines near Copenhagen, projected in 1926, came into force by a Bill passed in 1930. Conversion was commenced in the course of the same year. A total of 24 miles was electrified at 1,500 volts d.c., which is converted in four rectifier substations from three-phase current at 10 kV. 50 cycles, supplied by a privately owned grid.

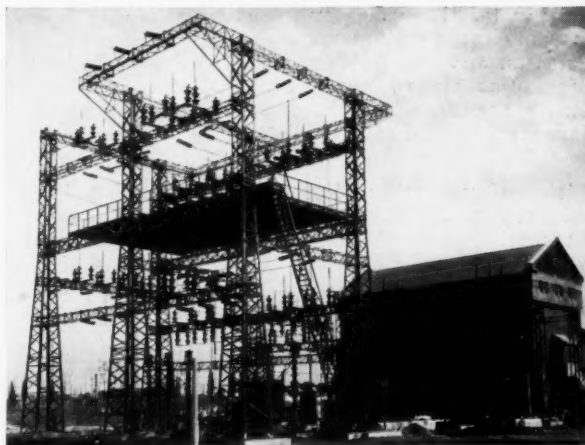
Holland

Electric traction was introduced in this country in 1908 with the line Rotterdam-The Hague-Scheveningen, with 11 kV. 25 cycles single-phase current. In view of the satisfactory results it was decided in 1918 to continue the electrification. Direct current at 1,500 volts was finally selected, necessitating alterations on the Rotterdam-Scheveningen line. Up to the present 142 miles have been electrically equipped.

The three-phase current supplied by privately owned stations is converted in 19 substations, in which, with two exceptions, rectifiers are installed. Owing to the heavy local traffic, multiple-unit trains are exclusively used as means of traction. The trains for through traffic, as well as the freight trains, are still hauled by steam locomotives. The results obtained with electric traction are very satisfactory both from the technical and economic points of view; the volume of traffic has risen considerably on the electrified lines.

Belgium

Until recently electric traction has been confined to the secondary lines of this country. The Vicinaux Railways, which controls 2,880 miles of lines, operates more than one-fifth by means of electricity. Recently more attention has been paid to electric traction on main lines, since its economic advantages have been repeatedly proved. The



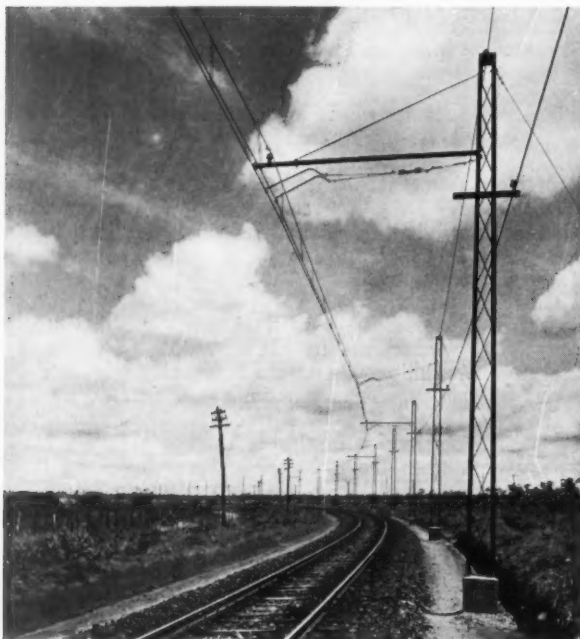
Outdoor h.t. gear bringing 90 kV. three-phase current into a substation on the P.O-Midi main line

Belgian National Railways, which runs nearly all main lines, has electrified the Antwerp-Brussels line. Later, the electrification will be extended to the Brussels-Arlon and Marloie-Liège lines. Altogether 193 miles of lines are to be equipped for electric traction to start with. A contact-wire voltage of 3,000 was selected, the current being obtained from steam-power stations.

France

The mileage of electrified lines amounts to 1,310. The greater part belong to the Paris-Orleans and Midi companies, which amalgamated in 1934. The main lines running from Paris by way of Orleans to Tours, and from Orleans to Vierzon and Brive, have already been electrified.

The Tours-Bordeaux line, 220 miles in length, which is to be electrified under the Marquet scheme, will



3,000-volt d.c. line of the Paulista Railway, Brazil

extend the service from Paris to those lines of the Midi Railway that are already operated by electricity. This company has electrified the majority of its lines in the Pyrenees, and also the lines Bordeaux-Pointe de Grave, Béziers-Neussargues, and Montauban-Toulouse-Narbonne-Sète. The Brive-Montauban and Bordeaux-Montauban lines are scheduled for electrification.

Spain

The railway system of this country comprises 10,440 miles of lines, 557 miles of which are electrically operated. The most important belong to the Spanish Northern Railway, which has electrified more than 250 miles, i.e., 9 per cent. of their system. The lines are mainly in the northern part of the country and form sections of the most important transit lines from north to south. They run through mountainous districts and in some parts have to negotiate heavy gradients. They are operated mainly with d.c. at 1,500 volts obtained from a three-phase supply, partly by means of rectifiers. The energy is supplied from water-power plants.

The electrification of the main line from Madrid to Avila in the north, with the branch line to Segovia, has been authorised. There are 90 miles of double-track and

41 miles of single-track with long gradients up to 1 in 60. The contact line voltage will be 1,500. The energy will be obtained from four undertakings which supply central Spain with energy, and from the recently built power station of Saltos del Duero, near the French frontier, which has a capacity of 160,000 h.p.

Northern Africa

In the French colonies of Northern Africa almost 440 miles have already been converted to electric traction. The greatest advance in this direction has been made by the railways of Morocco. The ultimate aim within the next 10 years or so, is the electrification of the Marrakech-Tunis line, and 350 miles out of a total of 1,500 have already been completed.

So far as the railways of Morocco are concerned, the western part of the system from Marrakech to Petit Jean and Fez has been converted to 3,000 volts d.c. The electrification was commenced in 1927, and 344 miles have been completed. A steam-power station in Casablanca and a water-power station in Sidi-el-Aida supply the necessary energy.

The Algerian Railways have electrified the section Duvivier-Oued Keberit of the Bone-Tebessa line. The work was carried out in 1929-33. This section comprises 67 miles, and d.c. at 3,000 volts is used. The line, on which are heavy gradients and numerous tunnels, mainly serves to transport minerals and had already reached the limit of its capacity when operated with steam.

South Africa

Electric haulage in South Africa comprises the suburban traffic near Cape Town and the main line in Natal. The electrification of the section from Daimana to Harrismith is completed, and a further extension of the line from Cato Ridge towards the south as far as the coast, and from Glencoe in a northerly direction as far as Johannesburg, is under way. A voltage of 3,000 was chosen to operate long-distance traffic; this is transformed down from three-phase current at 88 kV. in unattended substations.

Turkey

In Turkey the questions whether to introduce electric traction, together with the projected construction of a new line along the Black Sea, are under consideration. The proposed line will run from Eregli (the ancient Heraclea) along the coast as far as Filyas, and from there inland to Karabük, the total length of line being 100 miles. The aim is to connect the seaport of Eregli with the coalmines near the Black Sea, and with Karabük, which will become the centre of an iron industry to be created there. The traffic is extremely heavy; it is estimated that 15 trains of 1,200 tons will be run in each direction daily, merely for the coal transport from Catalagsi to Eregli. The energy required will be obtained from a steam-power station to be erected near the coalmines. The original scheme only provided for a line from Eregli to Catalagsi, for the electrification of which direct current at 3,000 volts was projected, but now that the programme has been extended single-phase alternating current at a contact voltage of 15 kV., and 16½ cycles, may be adopted.

India

In British India about 625 miles of the entire railway system of 47,000 miles are electrified; they comprise suburban lines as well as long-distance lines. Among the latter, the most noteworthy is the line running inland from Bombay. Near Kalyan, about 25 miles from Bombay, the line forks into two branches, one of which runs to the north-east by way of Igatpuri, the other to the south-east via Poona. The Bombay electric suburban

service was started in 1929. A d.c. voltage of 1,500 was chosen for the contact wire. The energy is supplied by a water-power and a steam-power station by means of 100 kV. transmission lines. The extension of the electric service beyond Igatpuri and Poona to a distance of about 1,030 track miles is projected.

Japan

Electric traction in this country dates back to 1895, when a line of $6\frac{1}{2}$ miles near Kyoto was electrified. Today, 220 miles, or 2.3 per cent., of the State lines, and 4,200 miles, or 58 per cent., of the local lines, are electrified. Only d.c. is used, at 1,500 volts for long-distance service and at 600 volts for the local services. Most of the energy is obtained from privately-owned stations, and is converted partly by means of rotary converters, but mainly by mercury-arc rectifiers.

South America

In South America it was Brazil which first introduced electric traction. This was in 1921 on the Paulista Railway, over a length of 179 miles, for which d.c. at 3,000 volts was chosen. In 1927 the Western Minas Railway, 45 miles long, was electrified at 1,500 volts d.c.

The satisfactory results obtained led in 1935 to a preliminary settlement of a contract between the Brazilian Government and the Metropolitan-Vickers Electrical Co. Ltd., for the electrification of the Central Railway from Rio de Janeiro to Barra do Pirahy and Santa Cruz with d.c. at 3,000 volts. The total route mileage is 94 and the cost was estimated at £3,000,000. The electrification is to be extended to other lines.

In Chili, in addition to three short sections, two other lines were electrified, in 1924 the State Railway line Santiago-Valparaiso-Los Andes, 145 miles in length, with a wide gauge, and in 1927 the Trans-Andean Railway. Both lines are operated with d.c. at 3,000 volts. The energy is supplied by water-power stations which obtain their water from the Andes.

Central America

The only State line in Costa Rica, 92 miles long, connects the capital, San José, with the seaport town of Puntarenas. The line has long gradients up to 1 in 40, and is single-phase 15 kV. 20 cycles.

In Guatemala only the steep mountain railway from San Felipe to Quezaltenago, $27\frac{1}{2}$ miles in length and with normal gauge, is operated with electricity.* Direct

current at 1,500 volts is employed for the contact wire, and is converted in rotary converters from three-phase current generated in a water-power station. This line is remarkable for the fact that there are gradients of 1 in 11 and of a length of almost $10\frac{1}{4}$ miles. This is proof that electric traction increases the range of use of adhesion railways.

United States

Not quite 1 per cent. of the 262,500 miles of lines in this country have been electrified. Electric traction is distributed among no fewer than 21 railway companies, and dates back to the year 1887. Direct current at 3,000 volts, and single-phase current at 11 kV. 25 cycles, are mainly used for main lines. In addition, some extensive systems are equipped with d.c. at 650, 1,500, and 2,400 volts. For single-phase traction, locomotives with commutator motors are used in addition to converter locomotives, for which the single-phase current supplied is converted either by split-phase converters or by single-phase d.c. converters. Until recently the Chicago, Milwaukee, St. Paul & Pacific Railroad had the most extensive system, some 875 miles in length. It is operated with d.c. at 3,000 volts. The Delaware, Lackawanna & Western Railroad built its lines for the same voltage. This company was the first to use exclusively mercury-arc rectifiers and multiple-unit trains with d.c. at 3,000 volts.

During recent years the Pennsylvania Railroad has electrified its lines extensively. In 1928 it was decided to convert the main line from New York via Philadelphia as far as Wilmington, and the lines running towards the west to the Susquehanna River with single-phase current at 11 kV. 25 cycles at the contact wire. This necessitated the conversion of the lines in the vicinity of New York, which had until then been operated with d.c. at 650 volts, to single-phase current. In 1929 the Wilmington-Washington line was included in the scheme. The electric service of the Pennsylvania Railroad is thus the most extensive in the world. The New York-Washington line is 225 miles in length. It is a double-track line the whole way, but sections of it have even four and six tracks. The traffic is extraordinarily heavy, 60 freight trains and 830 passenger trains running daily; 492 passenger trains are multiple-unit sets which serve the interurban traffic of New York, Philadelphia, Baltimore, and Washington. At the present time 1,080 miles of the Pennsylvania Railroad are electrified. Thirty-three substations with capacities of 9,000 to 27,000 kW. supply the line. When the scheme is in full operation, 800 million kWh. will be consumed for traction purposes.

* Electrically worked since its construction.—ED. R.G.



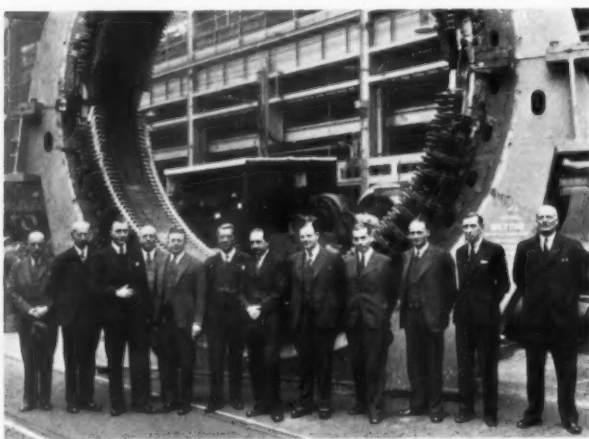
A passenger train on the 11 kV. 25-cycle single-phase system of the Pennsylvania Railroad

Notes and News

Italian Electric Extension.—Electric operation on the 3,000-volt d.c. system was begun at the end of April on the Trieste-Monfalcone-Gorizia-Udine line.

Another Swedish Electric Line.—The 103-mile line from Bölnas to Aange has just been opened to the standard 15 kV. single-phase electric traction. It forms part of the main northern route from Stockholm to Lapland.

Polish Commission in England.—During the course of the recent stay of a Polish commission in Britain, a visit was paid to the Trafford Park works of the Metropolitan-Vickers Electrical Co. Ltd., where equipment for the electrification of the Polish State Railways lines round Warsaw is under construction. The illustration on this page shows the party in front of a 12,500 kVA. three-phase 11,000 volts 50-cycle water-wheel-driven alternator



A group of Polish engineers and Metrovick officials at Trafford Park Works

for the Mettur hydro-electric scheme in India. Reading from left to right are: Messrs. T. Fraser (Metrovick); J. S. Peck (Director, Metrovick); J. Kielinski (Polish Commission); F. V. Biddlecombe (Metrovick); Sir Felix Pole (Chairman, Metrovick); Messrs. P. S. Turner (Director, Metrovick); A. Karlsbad (Polish Commission); K. Baumann (Director, Metrovick); I. R. Cox (Director, Metropolitan-Vickers Electrical Export Co. Ltd.); and Lt. Col. K. G. Maxwell, the manager of the Metrovick publicity department.

Streamlined Multiple-Unit Trains in Japan.—Four four-car streamlined trains are being built for the dense interurban traffic between Kobe and Osaka on the 1,500-volt d.c. system of the Japanese Government Railways.

Australian Prospects.—Strong advocacy is being given in New South Wales to the proposals that the main lines out of Sydney in all directions should be electrified for 80 to 100 miles, which would mean the equipment of over 1,000 miles of track. On three of the four routes being considered there is a dense traffic over heavy grades, but the matter is being pushed forward in order to assist the general electrification of the country just as much as in the interests of railway operation.

Electricity in Czechoslovakia.—A copy of the second international edition of the Czechoslovak journal *Elektrotechniky Svaz Ceskoslovensky* has reached us from the

editor at Vocolova 3, Prague. It contains articles in Czech, English and French on a variety of electrical engineering subjects, but traction is not included.

Swiss High-Speed Electric Trains.—As announced on p. 555 of the March 20 issue of THE RAILWAY GAZETTE, the Swiss Federal Railways have ordered two electric light-weight trains, to be delivered early in 1937. The order for the electrical equipment has been divided between Oerlikon, Brown Boveri and Sécheron, and that for the mechanical parts has gone to the Swiss Locomotive Works at Winterthur. The cost of each train is estimated at frs. 600,000. The motors are being designed for a maximum speed of 150 km.p.h. (93 m.p.h.). The two motor-coaches, of exactly similar design, will be separated by a trailer containing mail, baggage and second and third class compartments, and lavatories. Each motor-coach will contain third-class compartments and, at the end nearest the trailer, a transformer compartment surmounted by a pantograph. The total seating capacity of the three-car train will be 214. As in the present Swiss railcars, the doors will be pneumatically controlled by the driver.

L.N.E.R. Main Line Electrification

In the course of his lecture before the Institute of Transport on April 21, Mr. R. Bell, Assistant General Manager, London & North Eastern Railway, made the following references to the forthcoming electrification of the L.N.E.R. main line between Sheffield and Manchester.

The programmes of the companies differ widely in character, but three of them show a tendency for electric traction to spread. The Southern Railway is carrying its third rail system as far as Portsmouth. The L.M.S.R. is converting its lines in the Wirral peninsula on the same system and, by linking up with the Mersey Railway, will run its trains into the centre of Liverpool. In contrast to these orthodox extensions, the L.N.E.R. has a plan with one or two distinctive features. For the first time in this country, a section of main line will be electrified for both passenger and freight working. The railway between Sheffield and Manchester passes through the Pennines and is suitable for electric working because it carries a dense traffic on heavy gradients, while only one train is allowed in the Woodhead tunnel at a time in each direction. The length of the section, including four or five short branches, is 74½ miles and the single track mileage, including sidings, is 293. The 1,500-volt d.c. system will be installed with overhead equipment, and all the haulage will be performed by electric locomotives. It is estimated that 121 electric machines will do the work of the existing stock of 196 steam locomotives. Trains of every class will move faster. Half an hour will be saved on the running time of a braked goods from Sheffield to Ardwick, and no less than 80 min. in the case of a 1,000-ton mineral train to Guide Bridge. The average speed of the heavy train will be 27 m.p.h., double its rate of movement to-day. With electric traction the headway between trains passing through Woodhead tunnel will be 5 to 7½ min., instead of the present interval of quarter of an hour. The abolition of smoke in the tunnel will be a blessing and the life of the rails through it will be about half as long again owing to the better atmospheric conditions. Finally there is a plentiful supply of electric power along the route, and altogether it would be difficult to find a section of line, with a heavy mixed traffic, where the prospects of earning a fair return on the cost of electrification would be brighter. In this instance the net cost happens to be between £1,500,000 and £2,000,000, not a vast sum for a bold experiment which may mark the opening of a new epoch for railway operation in Great Britain.